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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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GENERAL

INFORMATICS INDUSTRY MANAGEMENT MUST BE PERFECTED

Tashkent EKONOMIKA I ZHIZN in Russian No 1, Jan 86, pp 18-21

[Article by D. Manyakov, chief of the computer facilities and management systems assimilation department of the UzSSR Gosplan, candidate of technical sciences, under the rubric: "Planning theory and practice"]

> [Text] "The principal problem of the twelfth five-year plan consists of elevating the rate and effectiveness with which the economic system is developed on the basis... of the intensive utilization of the created production potential and the perfection of the management system and the economic mechanism.."
> (From the draft, "Principal directions for the economic and social development of the USSR for 1986-1990 and through 2000.")

The UzSSR has 131 operating computer centers and 77 computer subdivisions in higher educational institutions, scientific research and planning and design organizations. The balance value of the computer facilities which have been put into operation and of peripheral equipment exceeds 180 million rubles, while thousands of people are employed in information-computing services.

This is great progress. However, the goal of this article is to uncover resources for the continued improvement of the informatics industry. Thus we will be speaking of the deficiencies in the current state of affairs that must be overcome. A low utilization level of capacities and high operations costs entail unjustified expenditures for the remuneration of information-computing service.

An underlying cause of low information-computing service efficiency is the lack of a common approach to developing hardware facilities. Only half of the operating computers are compatible, while altogether 24 types of computer are operated in the Republic. The non-uniformity of the hardware configurations hinders the exchange of automated management system (ASU) designs and results in unproductive expenditures for writing programs that implement the same tasks. The computer centers of the majority of ministries and departments of the republic are equipped with only one computer, which does not guarantee reliable service.

Guided by narrow departmental interests, ministries and departments are creating branches or departments of their VTs [computer center] in oblasts and rayons. This process is not supported by a thorough economic analysis and is accomplished without taking the information-computing service needs of the rayons into account, resulting in a dissipation of material and labor resources. The TsSU [Central Statistical Administration], Gosplan, Ministry of Agriculture, Ministry of Automobile Transport, the State Committee for Agricultural Machinery, and a number of other ministries and departments of the UzSSR possess and continue to develop independent VTs networks. These systems are not coordinated in the hardware and software aspects, which makes it impossible to create a unified republic computer center network (RSVTs) on their basis.

The perfection of the industry's management is inseparably connected with the complete implementation of the primary management functions: Goal coordination, prediction, planning, supervision, accounting and regulation. This concerns first of all the planned regulation of the process of automating every type of operation, including ASU creation. At the present, only the introduction of ASU is planned in the republic, while such aspects as the commensurability of planned costs and expected results are frequently solved on a formal basis, without the requisite justification. The lack of connections and coordination between industry and territorial organs makes it impossible to solve large-scale national-economic tasks with computer facilities.

The creation of territorial ASU (TASU) in the cities of Tomsk, Tula and Voronezh shows that the labor productivity of economists in oblast enterprise and organization management staff was increased by 15.4 percent over a four-year period, labor input for data processing was reduced by up to 35 percent, and the statistical report development period was shortened by 10-15 percent. Unwarranted delays are occurring in the development and introduction of the TASU in Uzbekistan.

ASU have been created in Moscow, Leningrad, Kiev and Yerevan that encompass most of the aspects of managing the economic and social development of these cities. Scientific industrial associations are occupied with their development and introduction, while collective-use computer centers (VTsKP) operate them. This has enabled the important social and economic city development aspects to be solved. The work being accomplished in Tashkent is unsatisfactory.

Automated dispatcher control systems for municipal passenger transportation have been in operation for more than 5 years already in Moscow, Kiev, Minsk, Orel, Alma-Ata and Grodno. The introduction of these systems places complete responsibility for controlling the transportation traffic rhythms on the shoulders of electronics. The Automobile Transportation Ministry of the UzSSR has frustrated the introduction of a similar system in Tashkent.

The subordination of VTs to various ministries and departments hinders and occasionally prevents the dissemination of leading experience. Thus, the computer operation team organization which has been implemented at the Uzbek Geophysics VTs and planning automation means and applied program packages developed at the Tashkent ASU Project and Design Office have not been widely disseminated.

The experience gained by the Uzbekbrlyashu VTs in automated warehouse inventory and of the Unified Central Asia Supervisory Control of the USSR Energy Ministry in using interactive videoterminals is not being utilized.

Departmental dissociation, the absence of supervision, and, occasionally, the lack of effective help have promoted a situation in which the development and introduction of systems have been subjected to unwarranted delay, the methodological and technical level of the created ASU are low, while their development costs have been significantly overestimated. An investigation conducted by the UzSSR TsSU showed that more than 30 percent of the systems that have been created are practically inoperable. In addition, the current requirements made of their scientific and technical level are not taken into consideration when the ASU are developed. Even systems that fulfill the same task differ significantly from each other. The development periods and costs are increased as a result, and by the time that they are completed, the major tasks that they fulfill no longer correspond to the actual relations within the management system.

Departmental barriers frequently result in the independent development of the same task by the VTs specialists of different ministries and departments. The absence of a Republic bank of algorithms and programs (RFAP) results in duplicate program development.

The presence of many departmental VTs and subdivisions and the difference in remuneration categories promotes a high degree of personnel fluctuation, especially of highly trained workers, who, as a result of staff restrictions, can not advance in their career. Considering the fact that the ASU creation period can be up to 3 years, this "migration" of specialists results in worthless expenditures, since it is practically impossible to finish "someone else's" program and the design process must begin anew.

The absence of a centralized register of existing developments opens the way to, in addition to duplication, abuse, in which developments are represented as original and independently created. Sometimes a specialist will create the illusion of working on a project over the course of several years, and when the time comes to implement it, he is fired. He often takes a new job with a higher salary. There is direct evidence of an unhealthy VTs pseudo-competition.

The tasks solved by the republic VTs primarily involve record-keeping, i.e., they possess a low efficiency level. For example, the Rayon Information-Computer Center of the UzSSR State Committee for Agricultural Machinery solved practically no optimization tasks while exceeding the equipment loading plan. More than 70 percent of the total task volume is occupied by material and technical supply tasks which are developed by the main, union organization.

An assignment to achieve ultimate economic progress from the application of computer facilities was approved in 1985 for the first time in the state plan of economic and social development of the UzSSR. However, the ministries and departments do not support this process. The work volumes and expenditures for information-computing service are not realistically coordinated with the demand that exists for them. Despite the fact that the demand for information- computing service in the republic remains unsatisfied, the planned work volumes of VTs have been reduced in many cases.

Dissociation impedes the integrated implementation of information-computing services. Leaving these problems up to the competence of ministries and departments makes it impossible to solve the problem of the optimal management of material, labor and financial resources of the informatics industry. Departmental principles for managing computer facilities also prevent the optimal maneuvering of these resources.

The absence of the conditions required to utilize self-financing methods, a weak technical basis, the impossibility of an optimal hardware configuration selection and limited financial resources prevent the normal organization of VTs work in the conditions of the existing organizational structure. The concentration of computational capabilities and peripheral equipment within the framework of an appropriate organ makes it possible to develop the VTs on the basis of a single technical policy and to create the conditions required to utilize forms of production organization based on profitability.

It is noted in the CPSU Program draft that the "Party considers as necessary the continued development and increased efficiency of State self-financing operations and the consecutive conversion of enterprises to solely profitability-based operation while fortifying key economic factors and reducing the number of indicators set by higher organizations."

However, the fraction of VTs that are operated on a true profitability basis does not exceed 15 percent of their total number. The conversion of the VTs to profitability-based operation is at times artificially checked by ministries and departments, since this entails enhanced financial supervision. The difference in the labor productivity levels means that production volumes that are justified by normative are achieved in the VTs by different human labor expenditures that are specified by the existing organization and technical equipment. Here one observes in many cases low labor productivity levels with high capitol-labor ratios.

An estimation of the capitol-output ratio, labor productivity and machine time use has shown that the volume of information-computing work in ministries and departments can be increased two-fold given an optimal work organization in the VTs and with the existing potential of computational capabilities and material and labor resources.

Thus, today, there has ripened in the information-computing service industry the objective necessity of bringing the management mechanism in correspondence to the level of development of production forces on the basis of concentration, specialization and cooperation, the introduction of profitability-based operation methods and the purposeful and flexible coordination of the production and economic work of the information processing industry's enterprises and organizations.

The examined problems of increasing managemental organization in the information-computing service industry can be successfully solved at the level of a special organ, which together with appropriate, legally consolidated rules and obligations, would have direct economic interest in this.

The information processing industry does not possess organizational or legal status at the present. Under the conditions of the "vertical" guidance of the economy that now exists in the nation, the information-computing service industry must be controlled by a specialized department. It has been proposed that a State Committee of the UzSSR for information-computing service (Uzkominformatika) be created to fulfill this role.

This committee will support an integrated information-computing service for Republic ministries, departments, enterprises and organizations which has the purpose of achieving the highest possible final indicators in economic sectors through the concentration, specialization and cooperation of information-computing services. This elevates the scientific and technical level, reduces the duration of the introduction period of developments, reduces costs, increases the volume of computational work (without enlisting additional resources), improves the quality of the information processing industry's product, and it increases labor productivity.

Responsibility for increasing the scientific and technical level of the industry and assuring an integrated information-computing service for clients must be left to the Uzkominformatika.

It has been proposed that the committee be formed by organizing a scientific-research and design institute for information-computing service (NIPI "Informatika"), intersectorial and interdepartmental branch information-computing centers (KIVTs) in Tashkent, a republic association called "Uzmashinform" that includes territorial VTsKP, an integrated computer facility maintenance center, and a prototype plant and instructional center.

It is advisable to organize scientific-research and design subdivisions, a Republic Bank of Algorithms and Programs and an expert commission within the framework of the "Informatika" NIPI.

The creation of territorial VTsKP and intersectorial and interdepartmental KIVTs must be accomplished on the basis of computer subdivisions in oblast centers and in Tashkent.

The exceptional importance of the territorial aspect in managing the information-computing service stipulates the expediency of creating territorial VTsKP in the oblast centers of the republic (since most of the information processing work is of a territorial nature). The territorial VTsKP will become the organizers of the intersectorial automation programs (TASU) in the territories served by them.

The intersectorial KIVTs in Tashkent can be created by concentrating the computational capabilities and labor resources of ministries and departments that are interconnected into production and social complexes, for instance, the "Agropromyshlennyy kompleks" (Agroindustrial Complex), while the interdepartmental KIVTs can utilize a sectorial principle, for example, the "Stroitel'stvo" (Construction) sector. It seems expedient to make the organizational changes a step at a time.

The relationship between the producers and consumers of the information-computing services- the enterprises and organizations of Uzkominformatika on the one hand, and the ministries and departments on the other- must be constructed on the basis of economic agreements. The organizational structure of the Uzkominformatika and its principles and system for interacting with the information-computing service users will create an "anti-expenditure economic mechanism" that stimulates the efficient utilization of resources allocated by the government for the creation of automated systems and the introduction of computer facilities and that would not permit ministries and departments to obtain capitol investment and resources from the government without a subsequent return.

The Uzkominformatika will also support an integrated information-computing service at all of its stages: The selection of automation tasks, planning and design work and the industrial use of the tasks. The Committee assures the creation of centralized and distributed data banks for both intersectorial/ interdepartmental and local use, and the organization and operation of RSVTs and a republic data transmission system.

The Uzkominformatika organization will provide stimulation for the efficient utilization of all resources by taking stock of them and through the introduction of progressive norms and standards, and it increases the material incentive of information processing industry enterprise workers to assure that the users of the information-computing service achieve the highest possible service indicators.

The calculated need for information-computing services throughout the territory of the republic was greater than 150 million operations per second in 1985.

At the same time, less than 80 percent of the computational capabilities existing within the republic are used. With the current rate of computer facility introduction in the UzSSR, an increase in the average daily computer park load of only 1 hour corresponds to the introduction of 20 new computers or the release of more than 20 million rubles of capitol investment.

Existing data indicating that the labor productivity of ASU designers in specialized planning and design organizations is 2-3 times greater than those of departmental VTs make it possible to state that an additional output of 4 million rubles of ASU technical planning documentation can be obtained by concentrating these forces without augmenting resources, which entails a savings of 12 million rubles.

The transfer of computational capabilities to the territorial VTsKP and intersectorial (interdepartmental) KIVTs makes it possible to reduce the yearly VTs maintenance expenditures by an average of 400 thousand rubles at only one enterprise. The concentration, specialization and cooperation of computational capabilities produce a three-fold increase in the number of users and a ten-fold growth in the volume of information-computing work.

It is noted in the CPSU Program draft that "The machine-tool industry, electrotechnical industry, microelectronics, computer science, instrument engineering and the entire informatics industry, which are the genuine catalysts for accelerated scientific and technical progress, must receive priority in development". In order that computer science and the entire informatics industry become such catalysts, it is necessary to create the requisite economic and organizational conditions in a new sector of material production: The information-computing service.

12678
CSO: 1863/350

HARDWARE

MINSK INSTITUTE DEVELOPS PERSONAL PROFESSIONAL COMPUTER

Minsk NARODNOYE KHOZYAYSTVO BELORUSSII in Russian No 5, May 86 pp 20-22

[Article: "Desktop Computer"]

[Text] The development of the first personal professional computer in the unified computer system was completed at the Minsk Scientific Research Institute of Computers at the end of last year. A state commission under the chairmanship of academician Ye. P. Velikhov made the following conclusion: It corresponds to the superior-quality category and is recommended for series production.

It is doubtful whether the wide reader, including even computer center workers, has a sufficient idea of the new direction in computer development. We asked Candidate of Technical Sciences A. P. Zapolskiy, one of the authors of this development, to comment on this event.

The rates of development and introduction of personal computers are compared with a geometric progression. We are witnesses to a revolutionary leap, when the accumulated experience with all its problems and contradictions, leaning on the created production base, opens up prospects for a qualitatively new level.

Before the end of the 1970's computer technology offered the consumer a wide spectrum of computer hardware different in its capabilities--from elementary microcalculators to supercomplex computer systems, whose productivity was defined at hundreds of millions of operations per second. However, there was a division of this entire spectrum into two parts: lower and upper. The lower, that is, portable--but primitive from the point of view of existing requirements--calculators or microcomputers. The upper, that is, hardware rich in its capabilities, but not easily accessible because of its high cost, large size, and the need to maintain a large staff of special service personnel.

Advances made in the field of miniaturization of electronic components (density of integration of elements of semiconductor circuits) and information input-output devices predetermined the opening of the era of personal

computers. As "bricks" for computer construction the series electronic industry offered inexpensive and reliable so-called large-scale and superlarge-scale integrated circuits. Several cubic millimeters containing tens and hundreds of thousands of transistors! Or, on the other hand, a flexible magnetic record (diskette), which makes it possible to record hundreds of thousands and millions of letters or binary decimal digits. Thus, it was possible to offer the consumer the capabilities of big computers in a desktop modification at a much lower cost and with a high reliability of functioning! These are personal computers. They can be freely placed on any work table. Only an electric socket is needed for operation. The consumption of electric power is several hundreds of watts, that is, the same as two or three electric bulbs.

Thus, the personal computer has arrived in the spheres of service, management, planning, engineering activity, scientific research, and, finally, instruction as a means of sharply increasing the efficiency of intellectual labor. The definition "personal" under no circumstances rules out the use of personal professional computers in the automation of collective labor. They can be unified into local networks, forming and supporting reference systems, collective instruction processes, electronic mail, and so forth. They can also join big computer systems and global teleprocessing networks.

According to the specialization of application personal computers are conventionally divided into three categories, that is, home, school, and professional computers. The latter include computers most developed in their capabilities designed for use in various fields of professional activity. The YeS1840 personal professional computer developed in our institute has also taken its place in this series.

The process of formation of domestic personal computers has taken place approximately within the last 3 years. The computers appearing during this time under the names of automated work places, terminal stations, or SM1800, Iskra 226, Agat, SM1810, and other microcomputers should be considered products of a transitional stage. These computers are characterized by particular initiative solutions and, as a consequence, by an incompatibility of architectural principles, an insufficient level of functional capabilities, and low reliability and technological effectiveness. Such shortcomings do not make it possible to organize large-series production and to use them efficiently.

Two of the personal computers developed last year deserve the greatest attention. They are Elektronika-85 and YeS1840. They have been developed in various sectors and represent professional personal computers meeting modern requirements of production and operation.

The YeS1840 is a computer of a desktop modification. The principle of construction is modular. Every functionally completed block which can be executed in different versions represents a separate module. There are five of them in the basic computer configuration.

The basic electronic module contains the electronic logic of the computer and its internal memory. The productivity of the processor of this module reaches

1 million operations per second and internal memory makes it possible to store just as many bytes. The entire electronic logic of communication with other modules is concentrated in it.

The basic electronic module also makes it possible to connect various additional means of professional orientation. They are needed for connecting personal professional computers directly into production processes, scientific experiments, and control systems. Furthermore, the module contains means ensuring the construction of local computer networks and information communication between the YeS1840 computer set. They can also be connected to large computer systems.

The dimensions of the module are 450X300X145 mm.

The keyboard module contains 90 keys divided according to purpose into alphanumeric and program-functional fields. The entire computer control is carried out by means of this keyboard. For the purpose of creating the greatest convenience alphanumeric keys are placed as in ordinary typewriters. The keyboard makes it possible to operate both with a Russian and a Latin text. The fundamental possibility of working with any alphabet--one of the important features of this computer--is ensured.

The dimensions of the keyboard are 486X190X30 mm.

The external memory module. This memory is represented by two mechanisms of information input-output from flexible magnetic disks-diskettes. The volume of useful information which every diskette can store amounts to 320,000 bytes. The dimensions of the module are 450X300X119 mm. Diskettes are the basic means of input and output of information files, that is, programs, initial data, and results of computer operations. Figuratively speaking, this is the consumer's library and archive.

The display module. A single-color screen with a diagonal 31-cm line, on which 25 lines--80 characters per line--are represented, is its basis. The screen is used for the transmission of operative information in the course of the computer process. In the very near future the alphanumeric display will be replaced with an improved graphic one with 16 levels of brightness. This will make it possible to observe, correct, and analyze different graphs, figures, sketches, and diagrams. A color graphic display will also appear next year.

The printing module is a matrix printer, which makes it possible to print any alphanumeric and graphic information on paper--96 or 132 characters per line at a speed of 100 characters per second.

The system software includes an operating system, a set of service programs ensuring operation with information carriers (diskettes), as well as an immediate correction and adjustment for specific operation parameters, a programming system in the Basic language, and a package of applied ABAK programs providing extensive capabilities for processing information given in the form of tables. In the very near future this software will be supplemented by various packages of applied programs, other programming

languages, and operating systems. A high reliability of equipment has been attained. The average mean time between failures is not less than 2,000 hours. The computer does not require special service personnel.

The Minsk Production Association of Computer Hardware has embarked on an expansion of the large-series production of the YeS1840 personal professional computer. During the 12th Five-Year Plan this hardware will be improved with a view to successfully accomplishing the important task set by the 27th party congress--to accelerate the rates of technical reconstruction of machine building and other sectors.

11439
CSO: 1863/331

UDC 681.269(088.8)

WEIGHT MEASURING UNIT BASED ON THE K580 MICROPROCESSOR SET

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 86 pp 25-26

[Article by Doctor of Physical-mathematical Sciences V.A. Pilipovich, Candidates of Technical Sciences A.K. Yesman and V.K. Kuleshov, and Engineers V.N. Bogachev, A.A. Savchenko and V.P. Dubrovskiy]

[Text] In order to efficiently utilize large cargo capacity trucks, it is necessary to monitor the loading of quarry dump trucks and provide on-line control of the loading process.

This paper describes the working algorithm and characteristics of a microprocessor weight measuring unit intended for the on-line monitoring and readout of the load level of a quarry dump truck. The operational principle of the unit is based on the measurement of the deformation of the suspension brackets as a function of the load. Measurements of the deformations of the suspension bracket stops on the BelAz-549 dump truck showed that during its loading up to the nominal level, the range of change in the deformations is 0 to 100 micrometers. In this case, the total of the deformations of the bracket stops for the front and rear suspensions changes in an approximately linear fashion within a precision of five percent. The necessity of high precision measurements in a wide range, the presence of hysteresis as well as the influence of destabilizing mechanical and climatic factors require the design of a new generation weight measuring unit, characterized by digital processing of the data incoming from the transducers and a programmed control algorithm for the weighing process.

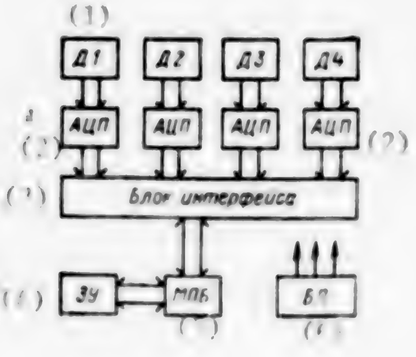

Figure 1. Block diagram of the weight measuring unit.

Key:
1. Primary sensors D1 - D4;
2. Analog to digital converters;
3. Interface;
4. Memory;
5. Microprocessor;
6. Power supply.

The weight measuring unit shown in Figure 1 consists of the microprocessor unit MPB (a standard MK-01 microcontroller), the memory M, the primary data transducers D1 - D4 with the analog to digital converters A/D as well as the interface and the power supply PB. The primary data sensor includes an ultraminiature 6MKh8B movable-electrode tube and a differential amplifier designed around the KR 544 UD2A integrated circuit; these are housed in a cylindrical container 35 x 100 mm. The structural design of the transducer precludes the possibility of the movable-electrode tube breaking in the case of displacements that go beyond the nominal range and also allows its direct mounting on the end of the suspension bracket stop of large cargo-capacity BelAz dump trucks.

During the dump truck loading, a signal proportional to the deformation of the suspension bracket stop is fed from the transducer output to the input of the A/D converter, which contains a K572PV1 integrated circuit and a data time storage register. The converter housing is mounted on the [illegible] plate of the suspension bracket close to the transducer.

Technical Specifications of the Transducer
and the A/D Converter

Range of measurable displacements, micrometers	0 – 250
Output code word length	8
Conversion nonlinearity, %	0.5
Speed, conversion operations per second	[illegible],000
Measurement precision, micrometers	1

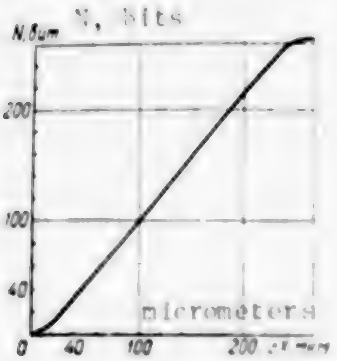

Figure 2. Graph of the conversion characteristic of the transducer with the A/D converter.

The conversion characteristic of the transducer with the displacement to code A/D converter is shown in Figure 2.

The digital code corresponding to the amount of deformation of the suspension bracket stop is stored in the A/D converter. The microprocessor acquires the data by alternately interrogating the transducer A/D converter registers and forwarding their contents through the interface to the memory, and then calculate the loads on the axles of the dump truck and the total load of the body in accordance with the algorithm whose flow chart is shown in Figure 3. The working algorithm of the weight measuring unit includes the following blocks: initial set-up and zero-set of the transducer readings, 1; information acquisition, 2; calculation of

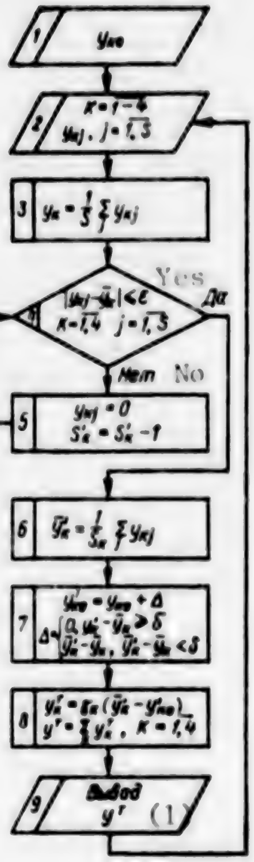

Figure 3. Working algorithm for the microprocessor assembly.

Key: 1. Output, y^T = load weight in tons;

y_{ko} = zero-set reading;

y_{kj} = transducer readings;

k = transducer number;

S'_k = number of edited samples;

y^T_k = load on the suspension brackets;

γ_k = calibrating factor;

S = number of samples.

the transducer readings, 3 - 6; compensation for the drift of the measuring component of the unit, 7; the calculation and analysis of the loads, 8; and the output, 9. The algorithm described here is distinguished by the presence of block 7, the operation of which is based on the fact that the drift in the transducer readings is slow, while the useful signal changed in a step-fashion during the loading process. The average value from the readout file is compared in block 7 for each transducer with the average value of the previous cycle. If the indicated difference in the average values is less than a specified quantity δ, then it is assumed that the change over the time between two adjacent cycles in the program is drift, and it is subtracted from the corresponding zero readings of the sensors.

The application of a microprocessor to the weight measuring unit makes it possible to do the following: use software to linearize the conversion characteristic of the unit; preprocess the transducer readings for the purpose of reducing the influence of random errors and external destabilizing factors; automate the set-up and diagnosis of the transducers.

The weight measuring unit makes it possible to provide on-line monitoring of the dump truck loading process and take into account the weight of the loads hauled per shift. When a load of 80% of the nominal level is reached, an external signalling light, a "blinking red light", is turned on for the

excavator operator; this light is duplicated in the truck cab for the driver. The reaching of 100% loading is accompanied by a "continuous red light" signal and the level of the load is indicated on a digital display in the cab.

The tests performed on the weight measuring unit designed around the K580 microprocessor set have shown that it meets the requirements placed on built-in weight measuring systems: the measurement precision is no less than two percent and the established load level is displayed in no more than two seconds.

8225
CSO: 1863/293

SOFTWARE

UDC 006.065:621.37/.39:681.3

PROBLEMS OF SOFTWARE STANDARDIZATION

Moscow STANDARTY I KACHESTVO in Russian No 5, May 86 pp 12-14

[Article by B.R. Kiselev, Gosstandart: "Problems of Software Standardization"]

[Text] The dynamic development of computers and rapid expansion of their applications call for intensive work to improve the development, production and follow-up updating of software.

Software development is a labor-consuming operation. It is well known that the share of software costs has been growing every year, as more and more programs are introduced to perform additional functions in data processing systems. Foreign experts have evaluated that the share of software costs for the first-generation computers (until 1955) was 15 percent of the total system cost, for the second generation (1955-65) 43 percent, for the third (1965-75) already about 70 percent and for the fourth-generation computers this share is expected to grow to 85 percent.

The potential for reducing the cost and improving the efficiency of industrial-scale development and follow-up updating of software is to a large extent determined by the quality and coverage of normative-technical documents (NTD) which set forth the rules for the development, presentation, recordkeeping and storage of software.

NTD cover all the stages in the design, operation and training and should observe standardized terminology used in software documentation; the nomenclatures and names of documents and systems of notation in similar documents describing various software components; in addition, all NTD for software should be similar regardless of their source, and everybody should follow the same rules in introducing amendments, as well as recordkeeping and storage of documents.

The rules for presentation of documents describing hardware that are currently in effect are in many ways different from those which apply to software documentation. This is determined by the specifics of the development, introduction, operation and follow-up monitoring of software, which in turn

determine the major features of software documentation as the object of standardization (including the need for preparing special documents for software such as program description, manuals for the system programmer, operators' manuals, etc.).

In order to ensure the unification and order in the all-national fund of algorithms, programs and software facilities for all generations of computers and data processing systems, a Unified System of Programming Documentation [YeSPD] has been created in the USSR.

YeSPD is a complex of interconnected standards which set out the general principles, types of software and program documents, the rules for development, presentation and circulation of software and software documentation. The system covers software documentation for all types of programs (operating systems, application programs, technical service programs, etc.) used to operate electronic computers regardless of the application areas (computer centers, computer-aided design systems, etc.).

The system as a whole and its component standards meet the following requirements:

- they ensure the unification of the rules in preparing and presenting documentation for software, so as to make sure that these documents are interpreted identically by the various organizations across the country and make it possible to recreate on a commercial scale software on the basis of documents prepared at a different organization with no need for additional adjustment;
- they contain the rules for the creation and presentation of documents describing software in a way to make the work of programmers more productive;
- they use notations of programs and relate to documents which reduce as much as possible the time of searching for the existing software and its components;
- they make it possible to utilize the present-day methods and facilities for document preparation and reproduction;
- they define clearly formulated rules for recordkeeping, storage and duplication of the documents and the possibility for their rapid revision; and
- they comply with the international standards and the experience of advanced foreign firms concerning the rules of preparation and presentation of software documents.

YeSPD consists of 29 nationwide standards for the first stage of the development, which define the intercoordinated rules for the development, presentation and circulation of software and software documentation; these standards make possible the following:

- unifying software products for exchange of programs and the use of existing programs for new projects;
- reducing the labor costs and improving the efficiency of development, follow-up services, production and operation of software products; and
- computerizing the generation and storage of software documentation.

It should be noted that follow-up services for software include the analysis of its operation, development and improvement with subsequent updating and revisions.

The rules and regulations set forth in YeSPD standards cover all software and software documentation for computer units, complexes and systems regardless of their applications and field of use.

YeSPD is comprised of the following standards:

- basic and organizational-methodological;
- standards defining the forms and contents of software documents used in data processing; and
- standards for computerized development of software documents.

Organizational and methodological documents which define and regulate the activities of organizations in the development, follow-up and operation of software are created in compliance with YeSPD standards.

The introduction of the first group of standards made it possible, even at the early stage, to:

- improve the performance of programmers;
- organize exchange of software documents among organizations, enterprises and computer centers without document reformating,
- improve the conditions for introducing, mastering, operating and updating software;
- reduce the time of program design and introduction and expand software design automation;
- speed up the circulation of software documents;
- raise the efficiency in the organization of a national fund of algorithms and programs and their central dissemination;
- reduce the software development and follow-up costs;
- raise the software quality and better organize software generation and follow-up; and
- eliminate duplication of software development.

The creation and introduction of the national standards regulating unified description of algorithmic programming languages Algams, Cobol, Fortran and Basic Fortran lay the foundation for standardizing software of automated systems. Even at the early stage it was possible to largely surmount the software incompatibility of computers, speed up the writing of programs for each particular computer model and obtain tangible economic effects by preventing duplication in writing programs for similar functions.

In 1985 the second stage in the national program of standardization and unification under the Unified System of Program Documentation [YeSPD-II] was begun.

Under the 12th Five-Year Plan a comprehensive program is to be put into effect to create a unified system of standards covering software resources and regulating on a common normative-technical base the rules, norms, requirements and test methods for all stages in the development of software as industrial-technological products providing a high degree of unification, distribution and applicability of computer programs.

To this end, in 1986-90 extensive research, development and design work will be conducted to prepare drafts of national standards for software products, applications, general systems and service programs and operating systems, as well as programming languages, including data control and manipulation languages and problem-oriented and computer-oriented languages.

Software Products

The main goal in standardizing software products is supporting the development and production of standardized software for computers and data processing systems on the basis of improved technological convenience and computerization level in the software production. Research in this area is conducted to formulate the rules for the creation and supply of software products regarded as products for an industrial-technological purpose, with a comprehensive analysis of the existing and promising new technologies of programming; it takes into account the experience of advanced foreign countries in order to establish:

- unified rules that would help reduce the time and cost of the development, production, introduction into operation and follow-up services of software for computers and data processing systems; and

- optimum nomenclature of programming processes and recommendations on standardization and nationwide introduction of these processes.

Simultaneously, research and development is conducted to formulate the general technological requirements for software products on various information media with a view to formulating the suggestions for NTD complex. to establish the appropriate technical requirements and to compile a classifier of software as a component of the All-Union Classifier of Industrial and Agricultural Products.

A set of standards is to be created that would define the general technological requirements for software products on various media, including national standards to regulate the general principles, test methods and life cycle phases of software products.

In addition, a set of standards will be developed to specify the requirements to the format and circulation of all document types (including software documents) on various data media (types and forms of documents on particular information media, the main titles, rules of recording, duplication and modification, rules for record-keeping for each information medium); this will include nationwide standards that would formulate the general rules for preparation, recordkeeping, storage, circulation and revision of documents on magnetic media. National standards are to be drafted to regulate the basic principles of the industrial production of software and data description in documents.

Programs

The principles of program standardization are currently being developed in particular as they apply to general-system application and service programs and operating systems. In this area, unified methods are being studied and developed to define the software quality and reliability; a system of structural-modular programming is being created to support the generation and support of typical and original programs; standardized methods and hardware facilities are being designed for software troubleshooting and testing of compliance with specifications and a unified system of program documentation is being developed and supplemented. These activities will lead to proposals on standardization of software establishing the standard methods of software reliability control, regulating the process of creation and follow-up of programs and operating systems and developing unified methods and typical tools for the testing of programs, basic translators and programming systems.

Programming Languages and Systems

In order to build an efficient basic set of languages and systems of programming that would meet the demands for large-scale use of computers in the economy with minimum duplication of effort, complex experimental design and development projects have been conducted to create integrated basic programming systems, including operating systems UNIX, Refal, Mason, Priz, Spora and Shkolnitsa and standard environment for the Ada language.

For creating a set of national standards it is necessary to produce standardized descriptions of the basic set of the promising universal programming languages (Fortran, Basic, Pascal, PL-1, Algol-68, Ada and C).

For developing translators for universal programming languages compatible with all computer systems, comprehensive experimental design and development work has been conducted to build a set of standardized translators from the basic set of such languages for various computer systems.

The expanding spheres of computer applications and the need for reducing the time and cost of preparing application tasks have resulted in the development of a system of programming languages (problem- and computer-oriented languages and data control and manipulation languages with the appropriate translators), which make it possible for lay users to program application tasks in terms of their respective subject areas.

Creating new "industrial" methods of software development for computer technology and control systems means a gradual transition from the creation of individual programs to "industrial" production of programs and software products to meet the need of users for software through a ramified network of the national fund of algorithms and programs [GOSFAP]. This calls for standardization in areas such as documentation of programs and software products; programming and follow-up processes; programming languages; testing of translators and utility programs, etc.

In 1986 the preparation and publication of normative-technical documents regulating the development and production of computer software will be completed. There are plans to create a guideline document for the classifier of software as a component of National Classifier of Industrial and Agricultural Products.

In addition, in order to raise the quality and efficiency of computer software development, it has been decided to institute national tests of software, including operating systems; the application programs for economic engineering, scientific and technical and information retrieval functions and general-purpose application programs, as well as service programs for technology, control and processing programs and software expanding the capabilities of operating systems.

The research and production association Tsentrprogrammsistem has been assigned as the head organization on state tests of software; the scientific and methodological guidance on the performance of these tests is provided by VNIIS [All-Union Scientific Research Institute of Standardization].

Such are the main areas of work in the coming five-year-plan period in the sphere of standardization of software resources, regarded as industrial-technological products.

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ARTIFICIAL INTELLIGENCE SYSTEMS

Moscow EKONOMICHESKAYA GAZETA in Russian No 31, Jul 86 p 21

[Article by G. Kochetkov and V. Sergeyev, employees at the Institute of the USA and Canada, under the "Equipment and Technology Abroad" rubric: "Problems in Using Artificial Intelligence"]

[Text] In the mid-80's business circles in the USA, Western Europe and Japan became more interested in the practical application of artificial intelligence systems (SII) which possess the capability of rationally selecting a course of action in a complex situation, an understanding of natural languages, pattern recognition and other properties.

Experimental SII models were created as early as two decades ago. Subsequent attempts to develop them for commercial use proved unsuccessful due to high cost and complexity in operational use. Yet, an increase in the sales of SII has been observed since the early '80's. They reached approximately 100 million dollars in the USA alone in 1984. According to specialists, by the 1990's the volume of such sales in the West will constitute a minimum of 2.5 million dollars or a maximum of 10 million dollars.

A Developing Field

A characteristic indication of changes with regard to the problems of artificial intelligence was, for example, the fact that large corporations in the American electronics industry which usually enter new markets with care (IBM, General Electric, Texas Instruments and others) announced their intention to produce commercial SII's. This sparked the interest of many medium and small firms in the new business. For SII users it served as an indication of an inevitable reduction in the level of potential risk during the introduction of new systems. Also indicative is a change in the attitudes of business to annual exhibitions of the products of firms which produce SII's. In the past, exhibitions only attracted the attention of scientists who freely shared the results of their research. But, since 1984, exhibitions are of a totally different, unscientific and more commercial nature. The commercial secrets of the developers are strictly held, and the primary attention is devoted to the economic aspect of the use of SII's and the market strategy for their use.

The development of SII's and the transition to their industrial production required a significant expansion of the user base in this scientific field. In the '60's the problems of artificial intelligence interested only a few small groups of highly-trained specialists in the strongest American academic circles (Stanford and Yale universities, and the Massachusetts Institute of Technology). Also, the very problem of artificial intelligence was studied as a field of fundamental science with an unclear future. However, at the present time, about 150 centers (not counting research centers in commercial firms) are functional, performing scientific work and training specialists.

As practical scientific research in this field shows, from the point of view of applications, significant results may be obtained only after a considerable expenditure of trained labor connected primarily with software for SII's. This relates in particular to the creation of language processors and natural language "man-computer" communication systems, the development of robot engineering devices and flexible manufacturing systems. The prospects for SII's in this field are extremely great even though developments in this field are only beginning to turn about, and detailed information is, as a rule, a commercial secret and often does not reach the open literature.

The Development of Expert Systems

One of the main prerequisites for intensifying the practical significance of SII's became the fact that definite experience has by now been accumulated in the application of computers for solving various problems involving data support for the processes of decision making. The directors of companies and government institutions have created the corresponding demand. Moreover, successful work has occurred on certain SII's, mainly the so-called expert systems. In expert systems a computer performs the functions of a highly trained expert in one or another narrow field. Such systems include the "Prospector" geological system, the "Dendral" medical system and others.

The developers of an expert system start with careful observation, questionnaires and interviews. Then they describe in detail the conduct of one or another group of trained specialists in complex situations. A generalized model is constructed on the basis of the description and installed in a system. Each time that an analogous situation is encountered in practice, the director may refer to the expert system and receive advice on how best to overcome the problems which have arisen. At the present time, the systems have been used on a broad scale to solve two types of problems.

One of them combines complex, combinatorial problems in which it is not realistic to directly calculate or evaluate all possible variants because of their great number. This includes, for example, the strategy of controlling economic or other organizations when the experience of experts makes it possible to select the most preferable variants by eliminating the unrealistic ones from them.

Another type of problem involves the necessity for the most rational interpretation of the numerous and diverse data entering control systems. Such problems arise, for example, when complex production processes are controlled,

and also in such fields as meteorology, geology, medicine, etc. The recorded experience of experiments in these fields enables us to isolate the most significant informational inputs and to make a generalized evaluation of a situation with, among others, the goal of determining the sites of fossil fuel deposits, making forecasts, and so forth.

The development of each effectively usable expert systems requires considerable man hours, and they are rather expensive when used singly. But, their cost drops abruptly when they are mass produced. The generalized experience of trained specialists may be disseminated to any number of installations. A production manager may have at his disposal a broad selection of expert systems in various sectors. This fortifies his positions significantly among competitors. The availability of such systems is starting to be viewed as an important strategic factor in the struggle for survival. The leading firms have started intensive development of their own expert systems, without permitting divulgence of the experience of their own experts. According to data in the American press, over 30 of the 500 largest American industrial corporations have begun developing such systems for internal use.

The following example is cited to evaluate the economic effect of expert systems. The fields propagated in the West which use such systems include, in particular, activity for controlling labor conflicts, which have increased rapidly in the last decade. Client firms find consultations with specialists in this field too expensive. After all, discussions over conflicts may last for months, and a workday of one such consultant from the "American Association of Mediators," for example, may cost a client firm several hundred dollars. Yet, the acquisition of expert systems with their relatively low operational cost, when operated on a large scale for such activity, saves firms considerable resources.

An evaluation of the prospects for using expert systems should take into account the rapid reduction in integrated circuits, the cost of the primary elements in the computer equipment. The cost reduction occurs as mass production of integrated circuits increases, personal computer prices drop and personal computers are used more widely.

The increasing scope of SII use further expands the introduction of second and third general personal computers used in various SII's. In particular, several expert systems have been created for the IBM XT personal computer. Thanks to the large production runs of such systems, their retail price has remained at the level of other application program packages (200 to 300 dollars per package). Expert systems implemented on personal computers for timely solutions to socio-economic management problems, conducting various negotiations and other forms of activity have been used on a particularly broad scale. In 1984 American stores dealing in software for personal computers sold over 150 thousand programming packages of this type. It is anticipated that by the year 1990 the number of expert system packages for personal computers will increase tenfold.

In addition, a considerable number of businessmen continue believing that the age of artificial intelligence has not arrived. In the business press,

a similar position is often explained by the biased relationship between managers of the old generation and computer technology and its use, an underestimation of the capabilities of new technological systems and a lack of skill in working with them. But even opponents do not dare deny the necessity for studying the capabilities of SII's and are in favor of earmarking new equipment for these goals.

On the whole, the information market and the computer revolution have gained a rather firm foothold in the business life of the West. Knowledge is viewed as the foundation of a nation's wealth in the information age. As opposed to traditional computers designed only for processing facts and data, computer systems with the elements of artificial intelligence are machines for specifically processing knowledge.

Competition and Militarism

It is noteworthy that the fifth generation computer project announced by the Japanese government in 1982 gave considerable impetus to the popularization of SII's in the United States. The primary goal of this project is the creation of a computer capable of communication with a human being in a natural language and possessing the capability to imitate human reasoning in various subject areas. For the first time a new generation computer is being formulated not on the basis of a change in technical design, as with earlier generations, but on the basis of a radical change in software. With the implementation of the project the Japanese would achieve an important strategic advantage over the United States. Therefore, in 1984 the American Congress decided on the development of a series of programs which acquired a name as pretentious as its publicity, the "Strategic Computer Initiative" (SCI). The framework of this large-scale national program plans to combine the efforts of Government, business and academic circles in the process of solving the strategically vital problem of creating a new generation of computer technology with built-in elements of artificial intelligence. Within the 5-year period 1984 to 1989 it is proposed to spend 600 million dollars on these goals.

However, the SCI did not elude the fate of other projects which may potentially be used for military purposes and, therefore, immediately ended up under the tutelage of the Pentagon. The directorate of long-range Defense Department research programs became the principal management agency of the SCI and the disburser of resources. In a special report dedicated to the SCI, Pentagon experts confirm that, to a considerable degree, arms systems and command and control systems equipped with "artificial intelligence" increase combat effectiveness against a "potential enemy" thanks to the ability to better forecast the direction of developing events in a rapidly changing situation.

It is no coincidence that the SCI aroused a strong negative reaction in academic circles not wanting to fall under even greater control by the Defense Department. Representatives of a number of academic scientific centers note that the Japanese program has less connection with the military and will basically operate directly in business, while the results of the

American program will quite often be hushed up by the Pentagon. Therefore, American business circles are uneasy that their Japanese competitors may derive serious advantages.

On the whole, at the present time, the USA, Japan and Western Europe are in a fierce competition to expand spheres for the practical application of developments in the field of artificial intelligence. The fate and role of this sphere of scientific and engineering progress depends, to a considerable degree, on the extent to which it succeeds in avoiding total servitude to imperialist military industrial complexes.

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APPLICATIONS

ASU-PRIBOR - FROM SOLUTION OF TASKS TO DEVELOPMENT OF AUTOMATED SECTOR PLANNING TECHNOLOGY

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[Article by O. V. Golovanov and S. A. Yemelyanov, Moscow]

[Text] Extensive experience has now been accumulated in development and operation of automated sector management systems (OASU). The best of them have become an integral part of the management system for the national economy and have received good marks from both leading specialists in automation of management and practioners--operators of control hardware. For example, an automated sector management system--ASU-pribor--has been functioning successfully for many years at Minpribor [USSR Ministry of Instrument Building, Automation Equipment and Control Systems]. The integrated planning and management system for material and financial resources, developed on its basis, was awarded the Prize of the USSR Council of Ministers in 1982 [1].

However, despite the positive results, specialists continue to be excited by further developments of automated sector management systems and their role under modern conditions and in trends of development. This problem is especially timely for current sector planning. No unified concept has been established here on methods of using computer technology and of economic mathematical models. Specific problems and the corresponding economic mathematical models are considered in most published papers and the conceptual problems of design of automated sector management systems remain unstudied with respect to current planning.

Various approaches to solution of current planning problems using computer hardware have now been tested in automated sector management systems. One can designate three directions with known degree of complexity: automation of incoming data summary, centralized direct planning calculations at the sector level and creation of a current planning system based on optimization economic mathematical models.

The first direction consists in automation of the summary of various planning documents coming from enterprises at the management, territorial and other levels. The computer formulates its own indicators on the basis of the suggestions of enterprises, formulated as established planning documents, which can be considered as drafts of the plans of enterprises, associations and of

the sector as a whole. From the practical viewpoint, implementation of this approach causes no special difficulties, since fulfillment is one of the simple operations of data processing on a computer. With respect to hardware, this processing includes sequential completion of the procedures of data input on the computer, checking of it, summarization of data and printout.

Because of its simplicity, this approach became widespread immediately after development of automated sector management systems. For example, it was used in the ASU-pribor system to process planning forms and applications for different types of material resources. It is now used in a number of automated sector management systems. Moreover, the limitation of this approach is also obvious.

Indeed, orientation only toward a summary of bottom-up data improves the content of the automated sector management system, which in this case only frees users from executing more or less laborious procedures of data generalization. The computer performs purely computational operations, mainly summarization of data, and simply does not prove that use of it in the given case is more effective than an ordinary typewriter. However, the functions of a sector management organization are naturally not limited by these simple operations. The automated sector management system essentially has no influence on execution of the basic functions such as analysis of the suggestions of enterprises, making management decisions and so on. Specifically, the automated sector management system as a tool of the data summary of enterprises has no effect on development of a balanced production plan, since the lack of conformity between the indicators coming from enterprises is not determined and is not eliminated.

A second approach, based on the use of computers for making direct computations of planning indicators on the basis of preliminary information, usually nomenclature production plans and a combination of article-by-article indicators of norms and standards (material, labor and so on), was planned in the automated sector management system in this regard. Unlike the first direction, this method permits the automated sector management system to "penetrate" more deeply into current planning. The automated sector management system is not obligated in this case to "be satisfied" only by those values of the planned indicators which enterprises propose, but can itself make the necessary computations and can use them to formulate its own "proposals" on drafting the plan.

Centralized direct planning calculations have now become an integral part of the mechanism of sector formulation of planned tasks on production volumes, compilation of material and technical supply plans and so on at a number of ministries, including Minpribor. For example, centralized calculations of the need for material resources not only freed enterprises of laborious work in compilation of applications for resources, but also provide the workers of the management apparatus with a tool which permits them to make the calculations independently, without the direct participation of enterprises. The accuracy of determining the need and scheduling the calculations are thus increased, the sector management apparatus is able to implement measures on a timely basis to support the sector with resources, which, in the final analysis, has a positive effect on the balance of planned tasks with material and technical support.

The presence of normative information in the automated sector manag[illegible] also permits one to include the arsenal of its means in distribution [illegible], typical for the sector management organization. Thus, plans for di[illegible] of allocated funds for many types of material resources are compiled [illegible] computer in the ASU-pribor system. To solve these problems, a nomen[illegible] production plan and item-by-item expense norms are used and the meth[illegible] distribution takes into account the degree of "importance" of th[illegible] manufactured, a reduction of expense norms, the presence of reserve[illegible] factors.

Thus, direct centralized planning calculations in the automated [illegible] management system make available new capabilities to the manageme[illegible] which it did not previously have, and they appear exclusively be[illegible] use of computers since the behavior of direct planning calculations [illegible] completely successful when done manually. Therefore, the [illegible] management system creates conditions in direct planning [illegible] the current planning system itself. At the same time, it should be noted [illegible] the effectiveness of this automated sector management [illegible] dependent on the quality of the input information, provision of the reliabili[illegible] of which remains a serious problem.

The third approach to automation [illegible] economic mathematical modeling and optimization [illegible].

The use of the optimization apparatus in current planning [illegible] basic and principle directions of development and improvement [illegible] steps of developing the automated sector management system. [illegible] optimization problems has been regarded over many years [illegible] quality criteria for evaluating the level of an automated [illegible].

At the same time, it must be stated that the number of optimi[illegible] planning problems in automated sector management systems, despite [illegible] considerable efforts to introduce them, continues to remain low, [illegible] attempts to use them did not also yield the expected econom[illegible] result in practice. The fact that current planning with regard to the [illegible] optimization lags considerably behind future planning is also indicat[illegible], which is explained by the "more rigid" requirements on compilation [illegible].

Detailed analysis of the problems of introducing optimization tasks in [illegible] planning in automated sector management systems is not included in [illegible] (the experience of ASU-pribor was considered in [2] this area[illegible] that one of the basic reasons for failure, we feel, is the insufficient [illegible] of computer solution of optimization tasks to the real process of [illegible] planning.

The difficulties of introducing optimization calculations of current [illegible] ASU-pribor are explained largely by the fact that the goals and time [illegible] these calculations, the forms of using the results and, mainly, th[illegible] user were not sufficiently and justifiably determined. As a result, the calculations were made periodically, sometimes during periods [illegible] was no longer possible, separate from the real needs of the ministr[illegible]

Thus, both advantages and disadvantages are inherent to each of the planned directions in automation of current planning and not one of them can claim to have priority development at the expense of the others. At the same time, as experience shows, the development of any current planning tasks in an automated sector management system maybe successful only if they are closely related to the process of compilation of the current plan in the sector and are organically "inscribed" in the existing economic mechanism. One can reach the following conclusion in this regard: a qualitatively new phase in development of automation of current planning is required and namely, development of automated current sector planning technology. The basic difference of this phase from the existing phase should consist in the fact that one should convert from solution of a set of one or another tasks to a technology, which "would free" the entire process of current planning from its origin and to confirmation and bring in the annual plans to executors.

This conclusion may seem obvious. However, analysis of work to improve sector planning indicates that it is still not always the basis for organization of work in practice.

Main efforts in design of an automated sector management system are directed as before toward working out the task as the "cornerstone" of the entire system. The fact that the number of tasks of the automated management system are regarded as a measure of their quality contributes to this. The greater the number of tasks, the higher the level of this system is assumed. A list of the tasks to be introduced comprises the main part of the technical assignment for development of an automated sector management system. The number of tasks to be developed and introduced is planned by the developer organizations as one of the most important indicators. This orientation leads to the fact that the developers willing or unwillingly break the process of management into parts, "cull" the necessary number of tasks and are involved only with them.

We note that the concepts used in calculation with this type of "culling" may be of the most diverse types, beginning with support of these tasks with information and ending in prospects for defense of dissertations.

The number of introduced tasks in the automated sector management system will increase continuously as a result of this approach. However, real improvement of planning is far from always proportional to this number. One can cite analogy with automation of production processes, which also does not produce the full effect if, along with high-performance equipment, laborious operations performed manually remain in the production process. Thus, introduction of separate tasks in sector planning, even those that do not belong to optimization tasks, does not produce the full effect if all of them are unrelated to a unified automated technology.

Indeed, current planning is not a single task or a combination of several tasks, but is a sufficiently long and complicated process, during which the planning organizations solve a number of different tasks, closely related to each other. Obviously, none of them alone is capable of encompassing this variety. At the same time, the total effect due to the use of computer hardware and economic mathematical methods can be achieved only with an integrated scope of all functions implemented by the sector management apparatus in compilation of the current plan.

Automation of separate tasks was necessary during the first phases of development of automated management systems. However, this approach can now be regarded as having outlived its usefulness. One should note the imperfection of the guiding methodical materials on problems of automation in this regard. These documents do not orient the developers toward working in the direction indicated above. For example, among the documents on automated sector management systems, there is none which would include a description of the technology itself of implementing one or another management process. Instructions on the use of individual types of information by the management personnel are worked out in the best case, but even they do not encompass the entire technique of the management process.

The technique of current planning itself, which is determined by the existing order of compilation of planning documents, acquires a primary significance in the outlined understanding of the goals of automation. On the whole, current planning at the sector level can be represented as an iteration process of multiple refinement and coordination of planned indicators. This coordination by management levels and also with functional subdivisions of the Ministry (material and technical supply organizations, capital construction organizations, financial organizations and so only) is managed by the sector organization (the planning economic administration).

The technology of current planning at the sector level consists in consideration of planning documents coming from interacting organizations and subdivisions and in making decisions on determination and refinement of the planned indicators. This process occupies in time the period from approximately January to December of the year preceding the planning year.

On the basis of which principles should automated technology of sector current planning be developed?

As is known, the sector occupies the middle position in the national economy, due to which the current planning process should be implemented in interaction both with the lower level (enterprises and associations) and with the upper level (USSR Gosplan, USSR Gossnab and other statewide organizations).

In this regard, the primary principle position in development of an automated sector current planning technology consists of the fact that it should completely encompass the entire process of current planning during the entire length of planning and in all form . It is on this complete scope that one should solve problems of selecting one or another methods and models of planning, computer hardware, the organizational structure of subdivisions and so on. The style of the management process (current sector planning in the given case) should be a reference point for solving the remaining problems of organization of work in the management apparatus

Another important feature in development of automated current sector planning technology is the iterative nature of this process. It is impossible to take all the factors into account immediately that affect the indicators of the annual plan, since many of them are manifested gradually when compiling this plan. The iterative nature of the process is manifested clearly in the relations of the sector planning organization with lower and upper levels as

management. There is a multiple exchange of indicators of the annual plan between the levels during current planning and the quantitative indicators are refined at each iteration and the substantiation of their determination is enhanced.

The current planning process should be organized with regard to existing requirements and established order, including that with respect to the time of presentation and receiving different types of planning information. Therefore, compilation of the current sector plan begins before all the input information arrives, regardless of some outside factors, specifically, without complete data on the demand for a product.

The efforts of investigators were directed over a long period of time mainly toward a solution of mathematical problems of the iteration process of formulating an optimal plan in multilevel management systems. However, the organizational aspects of this problem have not been adequately worked out. They are also faced by automated sector management systems, many of which do not adequately take into account the iterative nature of current planning. Since current planning is a process of gradual refinement and more concrete definition of planning indicators, the automated technology should "track" this process, accompanying it during all its phases by the necessary computation actions on the computer.

The next important principle of developing an automated current sector planning technology is the integrated scope of all indicators of the plan and of tying them in for the purpose of increasing the balance of the planned tasks with resources. Weak linkage of indicators with each other and incomplete balance of tasks with resources are some of the main deficiencies of current sector planning. This is also reflected in work to develop automated sector planning systems. Solution of separate planned tasks is useless without organic interrelationship of them. Therefore, an integrated scope of all sections of the plan is required in papers on current planning in the automated sector management system. The relationship of tasks in planning the volumes of production with support of enterprises and organizations of the sector with material, labor and other resources should be provided.

Implementation of this principle apparently requires not only that the "task-by-task" approach to design of an automated sector management system be gradually done away with, but also that the individual subsystems of the automated sector management system be distinguished. Instead of this, automated sector management systems can be designed according to the individual directions to which they are related, specifically, current planning (future planning of the development and allocation of the sector, planning of scientific and technical progress and so on may become other directions).

Yet another important position for development of automated current sector planning technology concerns planning calculations and the normative base used for this.

It is pointed out in the decree of the CPSU Central Committee and of the USSR Council of Ministers, dated 12 June 1979, "On improvement of planning and intensification of the effect of the economic mechanism on an increase of production efficiency and work quality" that five-year and annual plans of the

production associations (enterprises) should be "worked out" on the basis of economic and engineering calculations, without permitting the establishment of planned tasks only from the established dynamics of the corresponding indicators" (3, p 12). Practice shows that these calculations are made not only upon formulation of the plans of production associations (enterprises), but at the sector level as well. It is essentially important to know in this regard on the basis of which information and with what degree of consolidation they should be implemented.

Technical and economic indicators are now computed at a number of automated sector management systems on the basis of consolidated normative indicators. The advantages of using consolidated indicators are obvious: they permit one to reduce the volume of information to be processed, they facilitate preparation of input information and make the results of calculations "visible." It should be noted at the same time that the use of consolidated norms is inevitably related to the appearance of methodical errors. The latter are calculated from annual data, primarily from planning data, and therefore, the changes in the structure of the product manufactured during the planning year can essentially not be taken into account.

An alternative to this approach is making direct calculations on the basis of nomenclature production plans and on the basis of a system of item-by-item norms and standards. Consolidated norms should perhaps play a role in current sector planning. But another thing is important: it should "have" data on the production of items and on their main technical and economic indicators in order that the automated sector management system fully execute its functions.

Some specialists are doubtful of the feasibility of acquisition and storage of this information in an automated sector management system. Indeed, item-by-item data sharply increase the volume of information and pose very laborious tasks in handling to the sector computer center. However, one should also take into account another factor. First, statewide organizations place ever greater requirements on the sectors in substantiation of current plans with specific calculations and the methods of these calculations envision the use of item-by-item data. Second, the automated sector management system already has experience in creation and use of large data banks for item-by-item norms. Thus, centralized computations of the need based on a data bank of material norms, containing more than 3 million records, have been made successfully over a number of years in the ASU-pribor system.

Thus, the development of automated current sector planning technology should provide: completeness of the scope of the entire current planning process both in time and interaction with the upper and lower planning level, iterative nature of the process of formulation of the sector plan, an integrated scope of all sections of the plan and provision of a balance of plant tasks with resources and the possibility of substantiating the most important technical and economic indicators of the work of the sector with specific calculations based on the nomenclature item production plan and on a system of item-by-item norms.

The outlined principle positions were taken as the basis in work during the 11th Five-Year Plan to improve the ASU-pribor system [4]. They were implemented most fully in current planning of supply of the sector with material resources. The composition of the tasks worked out in the "Management of material and technical supply" and "Management of makeup" subsystems, encompasses the entire work cycle in planning of supply, beginning with preparation of the input normative data and ending with compilation of notifications and detailed orders for delivery of material resources and changes to them. The functioning of these subsystems implements the iterative approach to automation of planning; thus, calculations of the need of the sector for material resources are made several times as the planning information is refined and solution of the problems of distribution of allocated material resources among users is also iterative in nature.

A unified system for formulation of nomenclature production plans, on the basis of which the most important technical and economic indicators of annual plans of enterprises, associations and of the sector as a whole must be calculated: the volumes of production of commercial and normative net product, cost and profit, laboriousness and numbers, has been introduced in the sector in current technical and economic planning. Centralized computations of technical and economic indicators permit an increase of the substantiation of the planned indicators for superior planning organizations.

Investigations are under way in ASU-pribor to automate the other phases of current planning, primarily in formulation of the nomenclature production plan itself on the computer. The time and goals of making these computations have been determined: they are made during the period from April through May. The suggestions of the enterprises are already known at this time on the nomenclature production plan, which come in to the computer center prior to 15 February every year in the ASU-pribor system. Therefore, the goal of computer computations to formulate the optimal production plan consists in evaluating the proposals of enterprises by comparing them to the needs of the national economy, determined by marketing organizations, and also on the basis of analyzing the possibilities of supporting the production plan with material resources. It is determined during this analysis that some enterprises themselves formulated this production plan, which can be recognized as the best method and can be adopted without changes. Those enterprises whose nomenclature plan needs correction are determined at the same time; calculations of the proposed version are made in this case. The economic mathematical model envisions a combination of the use of heuristic procedures with optimization aids. Thus, those products which will satisfy the country's most important needs according to data of the marketing organization are primarily included in the nomenclature production plan. Moreover, the indicated plan should envision both a minimum retention of the production plan from the past year according to products for which demand exceeds the production capabilities and so on. The nomenclature plan is compiled by 80-90 percent due to these factors. The remaining part of the plan is formulated by solving the linear programming problem, where a "penalty" is used as an entire function for incomplete satisfaction of the needs of the national economy for instrument products.

The prepared version of the optimal production plan is sent to the enterprises for consideration and for taking into account proposals when compiling the final version of the nomenclature production plan.

The calculations showed the substantiation of the selected method of improving the current technical and economic planning, based on a combination of direct centralized planning calculations and automated formulation of proposals with respect to the nomenclature production plan. At the same time, much still remains to be done. The model to be used should be supplemented and, specifically, the material and labor resources should be more fully taken into account and the relationship of the ASU-pribor system to the ASPR [Automated Control System for Planning Calculations] and ASU system of marketing organizations should be improved. Therefore, investigations will be continued in this direction during the next five-year plan as well. The final goal consists in implementing the entire complex of requirements that determines the development of automated current planning technology in the instrument-building sector.

BIBLIOGRAPHY

1. Karpov, B. V., O. V. Golovanov, S. A. Yemelyanov, S. V. Polyak and B. M. Yakobson, "Kompleksnaya sistema upravleniya i yego obespecheniya resursami" [Integrated Production Management System and Support of it with Resources], Moscow, TsNIITEIpriborostroyeniya, 1982.

2. Polyak, S. V., "Experience of Development and Implementation of Current Planning Models," EKONOMIKA I MATEMATICHESKIYE METODY, vol 18, no 2, 1982.

3. "On Further Improvement of the Economic Mechanism and on the Tasks of Party and Government Organizations," Decree of CPSU Central Committee, dated 12 July 1979; "On Improvement of Planning and Intensification of the Economic Mechanism to Increase Production Efficiency and Work Quality," "Decree of CPSU Central Committee and USSR Council of Ministers, 12 July 1979, Moscow, Politizdat, 1980.

4. Golovanov, O. V. and S. A. Yemelyanov, "Improvement of Sector Planning During Functioning of Autcmated Sector Management System," "Tezisy dokladov Vtoroy konferentsii po optimalnomu planirovaniyu i upravleniyu narodnym khozyaystvom" [Report Topics of Second Conference on Optimal Planning and Management of the National Economy], Moscow, TsEMI AN SSSR, 1983.

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SOFTWARE AND DATABASE ORGANIZATION FOR ON-LINE MANAGEMENT SYSTEM OF TRANSPORTATION AND WAREHOUSE COMPLEX IN FLEXIBLE MANUFACTURING SYSTEMS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 86 pp 44-45

[Article by Engineer A.A. Mazurov]

[Text] The development of transportation and warehousing systems at the present time involving the preparation, transportation and replacement of tools, accessories and work pieces is treated as an aggregate whole with the on-line calendar scheduling, the information support for a section or shop, the real-time management and accounting as well as forecasting and the providing of dispatcher control. In this case, the daily shift assignment (SSZ) is the input information, coordinated with the microcomputer-equipped transportation management system and the functioning of the dynamic tracking and control model for the warehouse system. The basis for the calculation of the daily shift schedule is the calendar planning of the work of the subdivisions in accordance with the planning and accounting time intervals. The implementation of the daily shift assignment and the calculation of the transport routes are the major goal of the database organization and management.

This goal is realized by the following: the organization of the data structure, which is directed primarily towards the issuance of the assignments for the transport vehicles (the addresses); the inclusion in the database of a branch, linked to the tracking of the status of the warehouse locations; processing of the request data; the determination of efficient transport vehicle routes; and the correction of the sequence for the fabrication of parts (operations) on the equipment with the appropriate reflection of the changes in the database.

We shall analyze the database for the support of the implementation of the daily shift assignment; this database is constructed hierarchically by working from the following prerequisites. The top level of the database structure (Figure 1) is determined by a key, linked to the designation of the production module, the work station and the equipment. The search for the key is executed by request - a call for transport to the work station for the purpose of doing some particular work. The completion or continuation of the previous work is checked in the order of its execution in the case when a request is made. The computer memory always contains the numerical code for

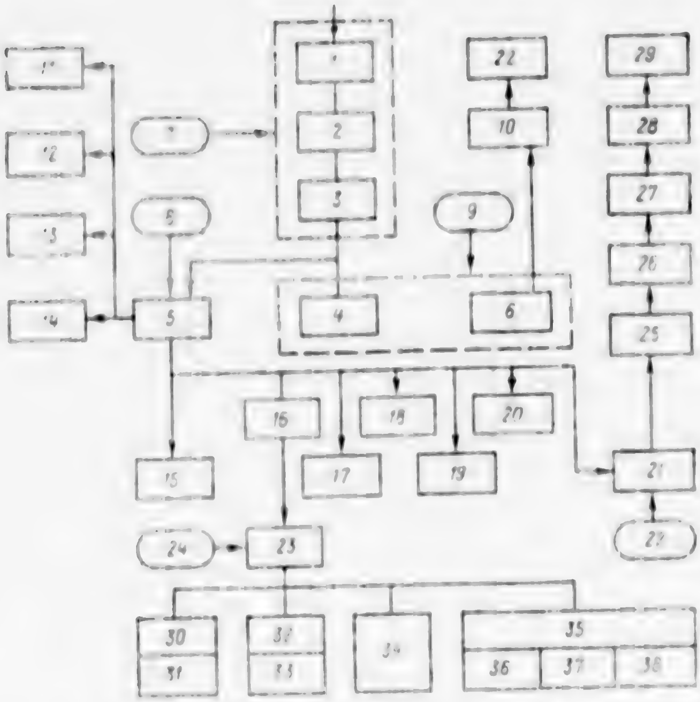

Figure 1. Files of the database organization and management system for a warehouse and the support for the execution of the daily shift assignment.

Key:
1. Section;
2. Work station;
3. Equipment;
4. [illegible];
5. Work;
6. Execution;
7. Key I;
8. Key II;
9. Key III;
10. Table number of a worker;
11. Operational malfunctions;
12. Actual time;
13. Timed standard;
14. Number of operations according to the plan;
15. Time norm for one operation;
16. Number of container units for shipment;
17. Number of container units supplied at the current point in time;
18. Criterion for passing quality control;
19. Container filling characteristic;
20. A number of accompanying criteria;
21. Criterion for forwarding;
22. Key V;
23. Location number (in warehouse);
24. Key IV;
25. Forwarding shop;
26. Forwarding section;
27. Forwarding work station;
28. Forwarding equipment;
29. Forwarding work;
30. Criterion for belonging to a location;
31. Work station, [illegible], tool storage warehouse, quality control warehouse, blank and work piece storage warehouse, transport vehicle section;
32. Filling criterion;
33. Empty location, empty container, parts, tools, spare location, etc.;
34. Number of container units per location;
35. Quality control functions;
36. Information on location occupation (1 = busy, 0 = free).

[Key to Figure 1, continued]:

37. Information on shipment acceptance (1 = turn over to; 2 = receive from; 0 = no information);
38. Reasons for operational failures.

the work being done. Consequently, the "work code" and the "sequence code" are located at a lower level of the structure. The third level of the structure is determined from the condition of checking the requisite data accompanying the work. For example, for an operation involving the machining of a part on the equipment, the following are checked: the sequence of the work support operation in accordance with the number of containers that are brought in; the machining time with respect to the normative time; the number of reject parts is written down if quality control operations are included in the operations, etc. The fourth level is defined in terms of the third level key with the designation "forwarding via the route", which entails the forwarding of the work to other equipment. It must be noted that keys I and III consist of attributes and are constructed using an M:1 ["many-to-one"] mapping, which is understood here to be a functional relationship. Each subsequent attribute in a key is an additional qualification criterion of the preceding attributes. Key I is the core segment of the database, consists only of the key and does not have any attributes following after the key. The segment contains only the key performing the role of a pseudo-index, and is intended to reduce the data retrieval time.

The database structure considered here makes it possible under operational conditions to construct the routes of the transport vehicles taking into account the priorities of operator messages, queries from the equipment of the worker-operators from the sections of receiving tables at work stations as well as automatic receiving and forwarding equipment. The routes that are constructed in real-time provide for the shortest production cycle, curtailing the "work" waiting time and promote the meeting of the set time norms by each worker in the case of the automation of the handling of requests from the work stations. The design of the software for calculating the routes of the transport vehicles $T_1, \ldots, T_N$, is accomplished by Petri net method, which represents a discrete dynamic process.

The network considered here, as regards the management of the transport, consists of the following events (programs): t_1^1 is the processing of the messages of the operators and the request messages; t_2^1 is the accessing of the information file for the execution of the daily shift assignment; t_3^1 is the determination of the equipment code and the section number of the work station receiving table based on the information in the request; t_4^1 is the determination of the execution of the previous work; t_5^1 is the determination of the "lag" of the work behind the schedule; t_6^1 is the determination from the address file of the receiving and forwarding of containers associated with the request under consideration; t_1 is the combining of the $t_1^1 - t_6^1$

programs; t_2 is the generation of the sequence of addresses "where from - where to" (the route) for a specific transport vehicle, the attribute "0" indicates the possibility of shipping the cargo by any means of transportation; t_3 is the transmission of the route or addresses to the transport vehicle T_1; t_4 is the arrival or accumulation of the addresses for T_1; t_5 is the transmitting of the information to the computer of the transport vehicle T_1; t_6 is the registering of the work execution and the filling of the warehouse locations; t_7 is the forwarding of information about a forced stop of T_1.

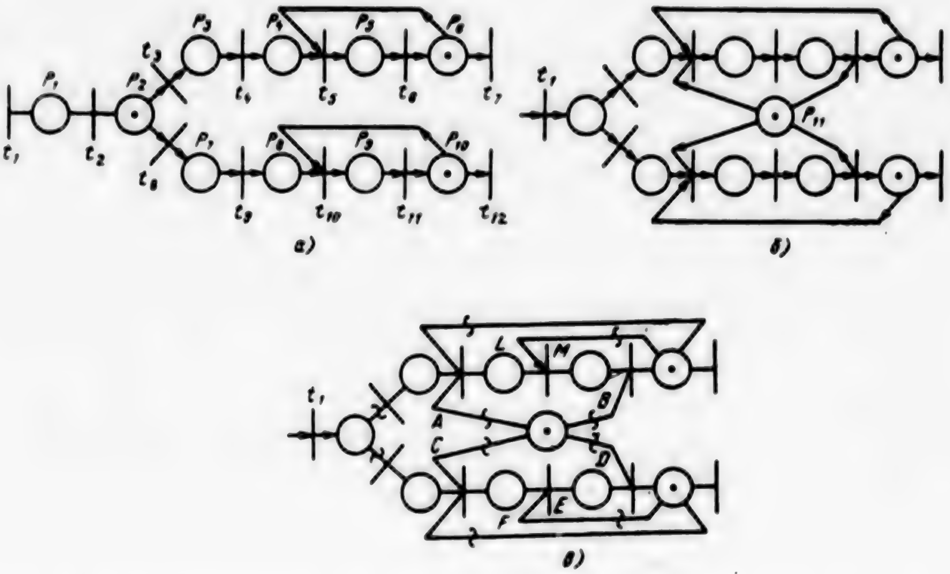

Figure 2. Representation of operation of transport vehicles by a Petri net.

Key: a. Variant for parallel operation of T_1 and T_2;
b. Variant for the sequential operation of T_1 and T_2;
c. Variant for the joint operation of T_1 and T_2;

Variant 1:

$$\{C, D, F\} \not\subset \Gamma, \quad \{A, B, L\} \not\subset \Gamma,$$
$$\{E\} \subset \Gamma \qquad \{M\} \subset \Gamma,$$

Variant 2:

$$\{C, D, F\} \not\subset \Gamma, \quad \{A, B L,\} < \Gamma,$$
$$\{E\} \not\subset \Gamma, \qquad \{M\} \not\subset \Gamma$$

Programs t_7 - t_{12} support the operation of T_2, programs t_{13} - t_{17} support the operation of T_3, etc. The t_6^1 program generates the addresses, in accordance with which the shipping of cargo is accomplished by several transport vehicles. For example, the first part is: the delivery of the load to the receiving and forwarding unit (PPU) from the warehouse store location; the second part is: the forwarding of the load from the PPU to the receiving

section of the work station table. The section at the receiving table and similarly, the load receiving section of the transport vehicle are treated as the warehouse store locations. Program t_2, consists of the analysis of the requests with the assigning of priorities for execution; establishing the servicing discipline through simulation modeling for the assignment as well as the schedule for the selected production work; the solution of the "p traveling salesmen" problem (the selection of the transport vehicle routes for the accumulated list of requests taking into account the priorities and disciplines for servicing them).

The operation of the transport vehicles is governed by the following conditions: P_1 is the generation of the "where from - where to" address; P_2 is the association of the next regular address with a particular transport vehicle; P_3 is the reception of the address for the transport vehicle T_1; P_4 is the wait for the freeing of transport vehicle T_1; P_5 is the confirmation of the completion of the route by vehicle T_1; P_6 is the freeing of transport vehicle T_1; P_7 is the reception of the address for transport vehicle T_2; P_8 is the wait for the freeing of transport vehicle T_2; P_9 is the confirmation of the completion of the route by vehicle T_2; P_{10} i. the freeing of transport vehicle T_2; P_{11} is the confirmation of the completion of the route by vehicle T_1 or T_2, which allows for the continuation of the execution of the route with a rigidly established sequence of actions for the transport vehicles.

Parallel and series operation as well as the combining of the parallel and series operation of vehicles T_1 and T_2 are represented in Figure 2. The parallel operation variant is realized by the introduction of a vector ψ having arguments of $\psi_C = \psi_D = \psi_F = \psi_A = \psi_B = \psi_L = 1$; $\psi_E = \psi_M = 0$. The series operation variant is realized by the introduction of $\psi_C = \psi_D = \psi_F = \psi_A =$ $= \psi_B = \psi_L = 0$; $\psi_E = \psi_M = 1$.

A Petri net with an inhibit is used for the specifying of the "where from - - where to" address by the operator from the display into event t_4 or t_9; in this case, $\tau(t_4) = 1$ or $\tau(t_8) = 1$. The transmission of the information that vehicle T_1 has "stopped" is accomplished by specifying the condition $\tau(t_7) = 1$. A similar tool is used for the internal construction of the t_1 and t_2 modules and is extended to a finite number of transport vehicles. The execution of the t_2 - t_{12} programs in the organizational and economic control loop (KOEU) computer and the automated transportation and warehousing system (ATSS) computer is the approach to the management of the transportation and warehouse complex in a flexible production system. The execution of the programs in parallel makes it possible to forward the routes from the organizational and economic control loop to the computer-aided transportation and warehousing system, and in the case of malfunctions, switch over to manual operation of the warehousing system with the control of the transportation by means of specifying the addresses from the displays. In the case of a malfunction of the ATSS computer-aided transportation and warehousing system, the operators feed into the organizational and economic control loop computer the addresses of the requests for transport services, and receive the routes for the transport vehicles. Information is fed into the

transport vehicle computer from the display through the data transmission interface. A modification of the Petri net makes it possible to design programs that combine the parallel and series operating units, and shift over to parallel or sequential operation in accordance with the conditions generated in the programs that analyze the queue of requests for an event. The structure of the Petri net takes the form of an aggregate of events and conditions. In accordance with this, the graph of the Petri net has two types of nodes: the small circles designate nodes named by the conditions P_i, while the vertical lines indicate nodes designated by events t_i. The set of conditions that are linked to a particular event by the lines running to it are called the input events of the given transition. All of the conditions to which lines run from an event form the set of output conditions for this event. A non-negative number is placed in correspondence with each point of the graph corresponding to a condition; this number is designated in the figure by dots inside a circle. The concept of labelling corresponds to the numbers. An integral-valued vector M is called a label; in this vector, $M(P_i)$ is equal to the number of points at the vertex P_i. A label is interpreted as a Petri net state. An event t_i generated during the labelling M, if $P \in I(t_i) \rightarrow M(P) > 0$ obtains, where $I(t_i)$ is the set of vertices P preceding the event t_i under consideration, while $M(P) > 0$ means that the conditions P have occurred. As a result, a generated transition (event) takes place. It is assumed that no more than one event can occur at any point in time. A label M is termed attainable if there exists a sequence of events $w = W(t_i)$ such that $M = \delta(M_0, w)$. The set of all attainable labellings is designated as $P(M_0)$. The concept of attainability is related to the concept of a true description of the process under consideration. The introduction of inhibited nets is a variant of Petri nets. P is a network with an inhibit and is determined by the excitation of an event if $P \subseteq I_0(t_i) \rightarrow M(P) = 0$ obtains, where $I_0(t_i)$ is the set of vertices - the conditions P, in which $M(P) = 0$, but the excitation of the event is possible. Excitation is specified by the condition $\tau(t_i) = 1$. This case is treated in the case of data input into an event; besides this, a Petri net modification is introduced, [remainder of article not supplied].

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AUTOMATION OF DATA PROCESSING IN ACCOUNTING FOR COMMODITY OPERATIONS

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[Article by Engineer Sh.Ye. Omarova]

[Text] Enhancing the efficiency of Soviet trade requires a further improvement in the management of trading enterprises and organizations. One of the most important directions for the resolution of this problem under present conditions is the extensive application of computer hardware and the development of automated management systems.

This paper generalizes advanced and practical experience with the organization of information support in automated data processing systems in retail trade enterprises.

The development of automated management systems for trade enterprises provides the more efficient utilization of resources and an improvement in the trading and financial activity indicators of an enterprise through the more timely processing of the economic trading information and the on-time delivery of the information to users; it is also provides for making valid trading enterprise management decisions as well as the improvement of the accounting and control system for the main economic activity indicators, a decrease in the number of administrative personnel and a reduction in commodity stocks, etc.

However, the level of information process automation in the trade sector continues to remain low; the distribution of automation systems in the sector is nonuniform. While almost 81.8% of the facilities at the level of trade ministries have computer data processing, at the level of retail enterprises and organizations, this is true of 9.2%.

The department store (univermag) has become one of the promising forms of a retail trade enterprise in recent years. The management of such a large enterprise entails the daily processing of a large amount of information, both that incoming from the outside and that generated within the enterprise. For this reason, the creation of automated management systems for these kinds of facilities takes on special importance at the present time.

In a trade neterprise automated management system, one of the first systems developed is the accounting subsystem. It is specifically accounting that is the major source of initial data used in the analysis and planning process. Of all of the administrative functions carried out in trading, accounting possesses the particular feature that it can be formalized in all stages of its execution, i.e., translated into the language of formulas and logical sequences. This makes it possible to practically fully automate accounting, starting with the writing of the primary document and ending with the compilation of the report, including the balance sheet.

The major component of the accounting subsystem is the commodity accounting and the operations related to it, which, in our opinion, is explained by the important part played by the accounting for commodity operations in the management of a trade enterprise and the considerable labor intensity of the accounting work. Commodity operations in retail trade characterize the economic process of bringing a commodity from the turnover sphere into personal consumption by means of exchange for the financial income of the population. The shipment, marketing and other expenditures of goods and packaging as well as commodity stocks are universally reflected in this process.

At the present time, commodity operational accounting tasks are being automated by means of computers at the Moscow GUM, the "Pervomayskiy" department store in Moscow as well as the central department stores in Kiev and Vilnyus, the "Gostinyy Dvor" department store in Leningrad, etc.

As is shown by the analysis of data processing systems for trading operations accounting (UTO) in service at the present time in retail trade organizations as well as database organization and management methods for trading operations accounting, they are still imperfect and do not support valid administrative decision making. As a rule, the data are organized in the form of individual files, rigidly linked to the program, for computer processing of the accounting data. A change in the structure of the files produces a change in the processing program. The number of files that can be generated and used is governed by the number of accounting tasks handled in the system. Thus, the more tasks there are, the greater the increase in the number of created files, which generates multiple duplication of the accounting data, increases the difficulty of updating and monitoring data reliability, and also raises the cost of storing and managing the data files on machine media. All of this does not provide for the conformity of the stored data to the actual parameters of the managed facility that is represented by the data.

One of the major tools for the elimination of the above drawbacks is the creation of an integrated accounting data processing system based on the concept of an automated database (ABD). The system makes the accounting data processing independent of the methods used for the organization of the data on the physical media, and allows for the minimization of information redundancy with a one-time input of the data as well as the utilization of the data for multiple purposes and the reliability of the storage and monitoring of the accounting information.

The automated database includes the database (BD) and the database management system (SUBD). The overwhelming majority of databases are local and have a limited number of applications. Frequently, several databases are created even when there is only one computer. Because of this, all of the accounting information in a trading enterprise may be organized in the form of a local database, which includes the database for executing the tasks of accounting for trading operations. Applications in the subject area under consideration here are queries of administrative workers concerning the presence and deficits of specific kinds of goods in the warehouses, in the sections, concerning the arrival and sale of goods as well as concerning the fulfillment of the retail commodity turnover plan. The creation of a local database for trading operations accounting (BD UTO) promotes an improvement in the database organization and management for computerized data processing in the UTO of the automated management system for a trade enterprise.

The structure and the composition of the BD UTO are determined through an analysis of the requisite specifications and indicators of the accounting data that comprise the basis for the organization of the peripheral database support and organization. This is due to the fact that the structural units of the lowest tier of the database are fields or elements, equilvalent to certain kinds of requisite specifications or indicators.

An analysis is carried out from the "output" of the information system with a subsequent transition to the determination of the initial data necessary to obtain the final results in order to ascertain the list of indicators for trading operations accounting and their interrelationship. Such an approach is quite valid and is explained by the fact that it is specifically the final results that are related to the implementation of specific management goals, and consequently, adminstrative decision making. A study of the totals printouts obtained during the execution of trading operation accounting tasks on computers has made it possible to ascertain the duplication of indicators in various UTO tasks, the inclusion of the initial indicators in derivative and final results, the relationships between the indicators and tasks under consideration as well as to determine the specific composition of the requisite indicator specifications in the form of a dictionary of requisite indicator specifications and an indicator catalog.

It should be noted that the algorithms for the resulting final indicators in trading operations accounting do not differ in terms of complexity. A multivariant nature of the calcultions of the data results does not exist in trading operations accounting (as in accounting in general) in the sense that is characteristic of analysis and planning. A distinctive feature of accounting information is the presence of a large mass of uniform initial indicators. The final indicators are, as a rule, generated by means of the multiple grouping of the intial data in accordance with various criteria.

An investigation of the composition of the indicators for trading operations accounting has also shown that relationships exist between the

indicators both within the set of UTO tasks of the accounting subsystem and with the indicators of other groups of tasks of the accounting subsystem and the subsystems of the trading enterprise automated management system. These linkages are algorithmic, semantic, syntactic and pragmatic relationships of the following types: "one-to-one", "one-to-many", "many-to-one" and "many-to-many". Moreover, the functional relationships were established between the requisite specifications and the indicators. The first group of dependent relationships was established between the designations of the requisite specifications - the criteria and their codes; the second group was established between the individual requisite specifications - the criteria, or between their designations, or between the codes, and the third group was established between the requisite specifications - at attributes and indicators [sic].

The above was taken into account in setting up the local database for trading operations accounting.

At the present time, a multilevel approach to the design of databases has become widespread in practice; this approach consists in the fact that the accounting data can be described at three levels: the internal, the external and at the conceptual level. The method of data representation in the computer memory is determined at the internal level; the external level is related to how the individual users conceive of these data while the conceptual level occupies an intermediate position between the internal and external levels. The formalized description of the total information contents of the database is specified at the conceptual level.

The logical structure of the trading operations accounting database is defined at the conceptual level. The following data models are used to represent the logical structure of the database for trading operations accounting in the automated management systems of trading enterprises: hierarchical, network and relational models. A distinctive feature of the hierarchical structure is the fact that a subsequent element is related only to one initial element, in which case, it cannot exist without the initial one. In a network structure, each element can be related to any others. The relational approach to data organization is the most promising for practical use. The basis for a relational data model is the concept of a relationship between the data, which can always be expressed in the form of a table (neither hierarchical nor network structures possess this property).

Relational type models are used for data processing in the "ASU-TsUM" ["automated management system for the central department store"] in Kiev. Their implementation is accomplished by means of the "Palma" database management system. However, because of the inadequate development of these types of models, the database management systems are less productive than DBMS's with a hierarchical or network structure.

The "TOVAR" [COMMODITY] and "OSTAT" [REMAINDER] databases, developed in the automated management system of the Leningrad Main Trade Administration have a hierarchical structure: organization - document - subject area. These

databases are used in the execution of the following tasks: "Products List Accounting for Commodity Stocks" and "Inventory Accounting for Commodity Stocks".

The information recorded by the following primary documents that detail the operations in accounting for the movement of commodity stocks is necessary in the design of the logical structure of the databases: the bill of lading for delivery within a trading enterprise, the document accompanying the goods, official document for rejects, the official document for overvaluation, the official write-off document, the official inventory document, the inventory of surpluses on the starting date for data processing, the commodity report and the list of inventories of remainders of commodity stocks. The "TOVAR" database contains the information on the movement of commodity stocks; the "OSTAT" database contains the information on the surpluses of commodity stocks. The main component of the databases contains the organization code and the subdivision code. Database implementation is accomplished by the tools of the "OKA" database management system. Because of the fact that the "OKA" DBMS is close to the limit of obsolescence, and also because there is no reflection of the linkages between "many-to-one" and "many-to-many" data types (for example, a relationship between the commodity codes and the warehouse numbers) and the inclusion of new segements or fields in the segments requires considerable restructuring of the system, in our opinion, the hierarchical approach to the creation of trading operations accounting databases is ineffective.

The network data model serves as the basis for the conceptual model of the UTO database. The selection of the network model is due to the following factors: 1) The structure of the accounting information is a network type structure, which is evidenced by the graphs of interconnections between the trading operation accounting indicators; 2) The network model is semantically clear for the user, provides for a natural separation between objects and linkages and is easily translated into the network data structures of the DBMS, which at the present time are becoming widespread, and in contrast to DBMS systems, are based on a relational model and are more productive; 3) The relationships that exist between the UTO indicators are primarily of the "one-to-many" and "many-to-many" type.

The basic concept of the network model of the data is the entry and the set. An entry takes the form of a set of elements (fields), joined to each other in terms of their meaning relationships (for example, one type of entry can combine all of the data about the presence of goods in a warehouse; another type of entry can include all of the information about deliveries, etc.). A set is the ordered aggregate of connected entries of various types that includes one entry for the owner of the set and a certain number of entries for its members. Diagrams, in which the names of the entries are shown by a rectangle, and the presence of a set type relationship between them is shown by arrows serve for the depiction of the network model. Each type can participate in an arbitrary number of relationships, and in the general case, the diagram corresponds to a network type graph.

We shall construct a fragment of the UTO database using the data of the compiled dictionary of initial specifications for the indicators and the catalog of indicators for trading operation accounting. We shall specify the specific requirement placed on the contents of the database: they must reflect the accounting for the arrival of goods of a given type (designation) at the warehouse of the trading enterprise over a 24-hour period, a 10-day period and a month. When poor quality goods are received, one must indicate what defects were discovered in the goods.

Before moving on to the construction of a fragment of the local database for trading operation accounting, we must determine which entries will be used in the construction and what the relationships are between them.

Diverse goods come into the warehouse of a retail trading enterprise, and consequently, a "one-to-many" (1:M) relationship exists between the "WAREHOUSE" and "COMMODITY" entry, which means: the "WAREHOUSE" entry will be the owner with respect to a member of the "COMMODITY" type of set. In turn, there are various kinds of commodities. Consequently, the relationship between the "COMMODITY" and "KIND" entries is 1:M. Furthermore, a commodity of the same kind (designation) arrives during the month; from this, the relationship has the form of 1:M, where the "MONTH" entry is a set type member, while "COMMODITY" is the entry-owner.

Various defects can be found in the same commodity, and each defect is associated with some kind of reject. This means that the entry describing a defect, "REJECT", is a set type member, in which the entry-owner is "COMMODITY". The relationship between "COMMODITY" and "REJECT" will have the form of 1:M.

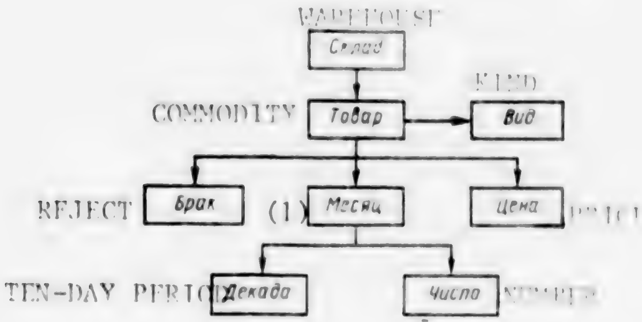
A commodity has different prices. Because of this, the relationship between the "COMMODITY" and "PRICE" entries is defined as a 1:M relationship.

There are three 10-day periods in a month. The relationship between the "MONTH" entry and the "10-DAY PERIOD" entry has the form of 1:M; the same thing will apply in the case of the relationship between the "MONTH" and "NUMBER" entries. This means that the "MONTH" entry is the owner with respect to the "10-DAY PERIOD" and "NUMBER" set type members.

The database can be constructed on the basis of the analysis made of the specific requirement placed on its structure. The initial entry in this case is "WAREHOUSE". A variant of the database structure for accounting for the arrival of goods over a month, 10-day period and 24-hour day is shown in the figure in the form of a diagram.

The logic structure of the database for trading operation accounting is constructed in this way; the basis for the database is a network model of the data. Finally, any object may be either a main or a subordinate object, i.e., act as the owner of a set or as a member of the set. This means that each object or entry can participate in any number of interrelationships, which is important when managing trading operation accounting at a retail trade enterprise. This structure of the UTO database also provides for the

generation of answers to user queries concerning commodities, their availability and remainders in warehouses and in the sections of trading enterprises as well as data on their internal movement, etc. The "EST" ["NETWORK"] DBMS is used in this case.



Variant of the database structure for commodity arrival accounting over a month, 10-day period and 24-hour day.

Key: 1. MONTH.

The creation of a local database for trading operation accounting eliminates duplication of UTO indicators, provides for integrated processing of the bookkeeping, statistical and on-line accounting data for commodities and the operations related to them, enhances the precision and reliability of the accounting information and promotes an improvement in the information support for the handling of UTO tasks, on which the functional efficiency of the automated management system of a trading enterprise depends to a considerable extent.

The automated management system in trade is one of the components of scientific and technical progress that will accelerate the shifting of the sector over to a fast developmental track and will improve the quality of retail enterprise management to a considerable extent.

8225
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PERSONNEL MANAGEMENT SYSTEM DATABASE OF THE MINISTRY OF THE ELECTRICAL ENGINEERING INDUSTRY

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 86 pp 35 - 37

[Article by Engineer A.A. Alipov, Candidate of Economic Sciences B.S. Krasilshchikov and Engineers A.N. Nikolayev and V.A. Panyutin]

[Text] Considerable work is being done in the electrical engineering industry in line with the resolutions of the April and October (1985) Plenums of the CPSU Central Committee to improve management, an integral part of which is the implementation of measures to enhance the scientific management of personnel. An automated personnel management subsystem, the OASU-Kadry, has been developed and is in operation in the sector; considerable work has been done on the automation of personnel management at a number of enterprises and organizations.

However, practice has shown that in order to successfully automate the processing of personnel data and establish the informational interrelationship between the various personnel management levels, it is necessary to determine and standardize the optimal composition of the contents of the input documents and the forms for the output documentation that assure the capability of computer generation of all of the information needed for the management of the personnel of enterprises and organizations; it is also necessary to standardize the terminological concepts of the database and the methods of data representation based on the use of standardized accounting nomenklatura coding systems and classification system for all enterprises.

Sectoral standard OST 160.801.091-83 was developed in order to meet these requirements: "Personnel Management Database System for Enterprises and Organizations of the Ministry of the Electrical Engineering Industry". Its purpose is to eliminate the defects that have been found in the organization of the computer processing of personnel information and improve the operation of personnel selection and placement based on an improvement in the operations of accounting for workers at enterprises and analyzing the information on them. The sectoral standard was developed in line with existing instructions for the organization of personnel management and in accordance with the requirements for drawing up all of the established

statistical reports and generating the information necessary for the on-line management of personnel. The sectoral standard is oriented towards the extensive utilization of modern computer hardware (the YeS computers) for the data processing.

The major organizational principle of the personnel accounting system under the application conditions of the sectoral standard is the differentiation of the information on workers with respect to the different forms of the input documents. This procedure should provide for decentralized collection of information and documented authorization at the points where the information is generated as well as centralized processing in the computers centers of enterprises. All of this assures the reliability of personnel information and provides for updating the database; the workers of personnel departments are freed from the necessity of gathering an entire body of information, the correctness of which cannot be checked by them.

It is necessary to store diverse information on workers on computer media for the functioning of the personnel accounting system based on the sectoral standard and the utilization of computers for the data processing; this then enables a more valid selection and placement of personnel. Provisions are made not just for the simple replacement (correction) of some information on workers with other information, but rather the storage on the computer media of exhaustive information for the entire work period of the given worker at an enterprise (for example, when a doctor of sciences degree is awarded to a worker, the computer media also preserve the information on the time that he was awarded the candidate of sciences degree, etc.). In this way, the curiculum vitae of the workers containing extensive information is managed on computer media; one can then generate statistical and on-line data needed for personnel management on this basis with the computers.

The sectoral standard includes the following sections: the forms of the input documents; the information classification system; the standard output document forms, the contents of which regulate the organization of personnel acounting at enterprises and provide for its uniformity throughout the entire sector.

The primary documents recommended by the USSR Central Statistical Administration were adopted as the basis in the development of the input document forms; these primary documents were revised for the purpose of meeting the standardization requirements as well as being adapted for computer processing as applied to the utilization of the database. The accounting data that are contained in the input documents are subdivided into the following information groups: general biographical information; information on education, skill levels and knowledge of languages (foreign languages and those of the peoples of the USSR); information on honorary titles and state awards, increases in skill levels, creative activity, public activity, certifications, inclusion in the reserves for promotion as well as information on the health status (illnesses contracted).

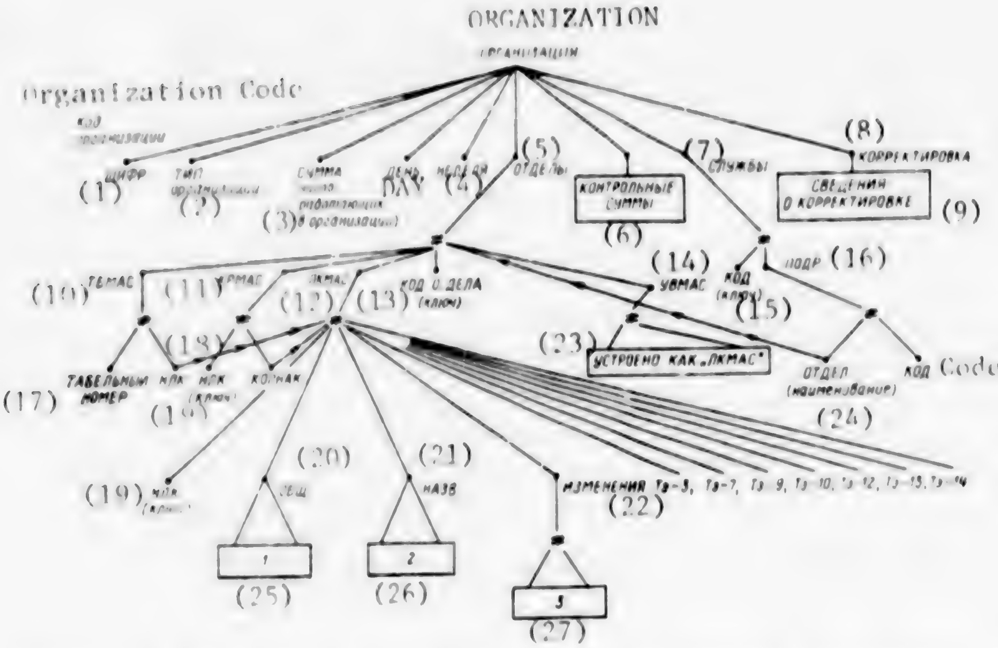

Figure 1. Data tree of the "personnel" automated management system database.

Key:
1. CODE NUMBER;
2. TYPE of organization;
3. TOTAL (number of workers in the organization);
4. Week;
5. DEPARTMENTS;
6. CHECK SUMS;
7. SERVICES;
8. CORRECTION;
9. INFORMATION ABOUT THE CORRECTION;
10. TBMAS = File of table numbers;
11. KRMAS = File of correctives:
12. LKMAS = File of personal data cards;
13. DEPARTMENT CODE (key);
14. UVMAS;
15. CODE (key);
16. PODR [?SUBSECTION?];
17. TABLE NUMBER;
18. NLK;
19. NLK (key);
20. OBSHCH;
21. NAZV [?NAME?];
22. CHANGES in Te-3, Te-7, Te-9, Te-10, Te-12, Te-13, Te-14;
23. SET UP AS "LKMAS" ["FILE OF PERSONAL DATA CARDS"];
24. DEPARTMENT (designation);
25. Information of the input documents of forms Te-2, Te-6, Te-4, Te-8 and Te-10;
26. Information of the input forms of Te-1 and Te-5;
27. Forms of the input documents: Te-1, Te-2, Te-5 (information in the forms: Te-3 = bonuses and fines; Te-7 = participation in electoral organs; Te-9 = = travel abroad; Te-10 = = inventions; Te-12 = published papers; Te-13 = dissertations; Te-14 = information on party work).

[illegible] data are formatted in two blocks in the creation of the data base on computer media: the main block and a supplemental block; the main block [illegible] on the basis of the personal data card and the job acceptance order, which contain the information used for drawing up the statistical report as well as in the process of timely personnel management. The main database block is updated with new information provided for in the sectoral standard; these are orders for transfer to other work, taking leave, terminating the labor contract, awarding bonuses or levying fines, as well as information on the enhancing of skill levels and traveling abroad.

In order to more completely analyze the information on personnel for the purpose of improving selection and placement, data are needed that form a supplemental block of the database; this information is formated using the input documents provided for by the sectoral standard directly at the places where the information is generated. This improves its reliability and frees the personnel department workers from the laborious work of collecting the information. Such documents are the information on public work and participation in the work of elected organs, the results of certification and promotion in the reserve of scientific and engineering personnel as well as information on inventions and efficiency improvement proposals, published papers, information on graduate degree candidates, as well as the sick-leave time sheets (the standard form).

In order to have uniformity in the presentation of information at all management levels, the sectoral standard establishes a standard system for the coding of the information based on the extensive use of statwide and sectoral classification systems. This eliminates the necessity of recoding the information when drawing up a statistical report and provides an informational interrelationship at the level of the machine media of the enterprises with the OASU-Kadry [sectoral automated personnel management system] as well as the computer generation of all of the output documents necessary for management operations.

The sectoral standard provides for the generation of about 200 staff output documents, the form and contents of which make it possible to complete the statistical reporting, satisfy the requirement of enterprise management for various operational data and facilitate the analysis of composition and transfer of groups of workers. Besides the group summaries necessary for completing the statistical reporting, the sectoral standard establishes the computerized issuance of various lists of information, based on which an individual analysis is made of the complement of personnel (workers newly accepted for work and those let go) as well as information characterizing individual workers (objective evaluations), needed for personnel selection and placement as well as the certification and preparation of the characteristics.

Because of the orientation of the sectoral standard towards the use of computers for personnel information processing, software support was simultaneously developed for it. The goal of the development of sectoral standard software support is the creation of the conditions for the acceleration of its implementation, the automation of personnel accounting

and the reduction of the cost of setting up the ASUP-Kadry [Automated Personnel Management System] at sector enterprises. The software support for the sectoral standard was designed around database concepts as applied to the SUBD INES [Database Management System for the Economic Information System] (version 3.4), recommended by the USSR State Committee on Science and Technology for extensive implementation and application and was based on the operating system of the YeS computers.

The set of programs for the sectoral standard software support is subdivided into two groups: service programs for servicing the database and programs for generating answers to user queries.

The service programs include the following: "Input Information Moni[illegible]", "Database Correction", "Database Cleanup", "Interactive Operation", "Data Transfer to the OASU-Kadry Subsystem", etc.

The service programs, as well as some of the programs of the second group of the program set, that require the generation of various parameters, the sorting through a large number of data tree vertices (Figure 1) or are most frequently used for accelerating the solution of problems, are written in the ASSEMBLER language and are formated in the form of load modules, which are put together in a library of starting modules.

The selection of the software tools for the generation of responses to user queries depends on the nature of the set task. In the case [illegible] corresponds to the form of the standard output document provided by the sectoral standard, the generation of the response to the query is organized by starting one or more of the ready-made programs. If there is no previously prepared form of an output document for a query, then its requirements are evaluated and the standard program from the library of original modules is modified taking the requirements into account, and this standard program provides for the generation of the response most appropriate for the user query. The query modification is supported by the simple aids of the INES [economic information system], is of a temporary nature (i.e. for the query handling time) and expands the scope of possible user queries practically without limit. This promotes an improvement in the promptness and validity of decisions made in the personnel management process. In the development of the software support, special attention [illegible] devoted to the protection of the database information against unauthorized access and the possibility of searching for data in accordance with [illegible] key criteria.

In order to implement the principles of the sectoral standard and its software, a technology was developed for the machine processing of personnel information based on the YeS computers, which makes it possible to introduce the standard automated system for personnel management in the sector enterprises: the ASUP-Kadry.

The system creates the prerequisites for improving the work of personnel selection and placement at sector enterprises based on an improvement in [illegible]

consideration and analysis of information on personnel and a reduction in the labor intensity of these procedures as regards the retrieval, storage, processing and representation of personnel data.

The subsystem developed for the computerized personnel data processing is a general purpose system suitable for managing all categories of personnel from both sector enterprises and organizations: scientific research institutes, design offices and design institutes. It is open both to the expansion of the database (BD) through the incorporation of new input documents and particulars, and to the establishing of the information interrelationships with other subsystems at the enterprise and sector level.

All major subdivisions and enterprises participate in the generation and management of the database, as is shown in the information model of the ASUP-Kadry (Figure 2); their task includes providing all of the available information on each worker in order to assure the completeness of the information on the personnel complement of an enterprise. As can be seen from the information model, the operation of the ASUP-Kadry provides for the following subdivisions, which have definite functions assigned to them: the personnel department (OK) handles the generation and management of the database (BD) by means of providing the following input documents: the job acceptance order, the personal data card, the labor agreement termination order, transfer to other work and vacations, information on participation in the work of electoral organs, travel abroad and certifications; participation in the continual updating of information classification system lists in step with the arrival of information concerning changes in them; forwarding requests for the generation of the requisite summaries to the maintenance group (GS) of a computer center in accordance with the listing of output document forms of the sectoral standard or the generation of new ones in accordance with the regulations established at an enterprise.

The department of labor and wages (OTiZ) participates in the preparation and presentation of vacation and job acceptance orders as well as other information to the computer center for the generation of the database.

The shops (departments) (Ts) participate in the preparation and presentation of order concerning the personnel complement to the computer center: information on the results of certification and the published literature of workers.

Information on inventions and efficiency improvement proposals by workers are fed to the computer center from the patent department (PO) or the efficiency improvement and invention office (BRIZ); information concerning education as a graduate student is provided by the graduate student department (A), and when this department does not exist, the information is provided by the personnel department. Information on public work and participation in electoral organs as well as the awarding of bonuses or the levying of fines are supplied by the electoral organs (VO) and public organizations to the computer center for the generation of the database.

The input documents in the computer center are turned over to the maintenance group, which coordinates all of the work of supporting the operation of the automated personnel management system. The maintenance group (GS) includes data preparation operators and computer operators who know the procedure for the utilization of the ASUP-Kadry software.

The data preparation operators transfer the input document data to machine media (punched cards or magnetic tape), check the reliability of the data entries and subsequently forward the checked information to the computer. Displays are also provided for the initial data entry. The initial data are transferred to the machine media in accordance with the developed formats using data preparation peripherals. As practice has shown, it is especially efficient to utilize multiple console data preparation systems for entering the initial data on magnetic tape; the use of these simplifies the process of producing the working tape and generating the database.

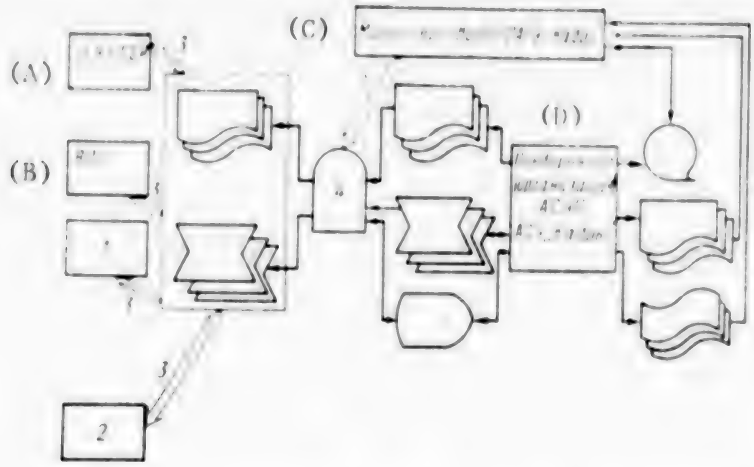

Figure 2. Information model of the personnel management automation system.

Key:
1. Statistical administration of a city or rayon;
2. Electoral organs, public organizations of a city or rayon;
3. Data flows;
4. Subdivisions participating in the generation of the database;

A. USSR Central Statistical Administration;
B. All-Union Production Associations;
C. Ministry, subsystem of "personnel" sectoral automated management system;
D. Enterprise (organization) of the "personnel" automated management system, automated enterprise management system.

The maintenance group prepares the documents for computer processing or assigns the tasks to the service group for the generation and maintenance (supplementation and correction) of the database, handles user queries for drawing up output documents provided in the list and album of output forms or generated by the maintenance group on the basis of requests from subdivisions with the offical stamp of the personnel department, if a modification is to be made in the standard forms of the output documents established by the sectoral standard.

Besides preparing the requisite information for the subdivisions of an enterprise in accordance with the established schedule, the maintenance group issues the information needed for the OASU-Kadry [sectoral automated personnel management system] by means of transfering the data to magnetic tape in a query mode. In the development of the ASUP-Kadry, a provision was made not only for an information interrelationship with the OASU-Kadry, but also with other sector and enterprise subsystems at the machine media level. This information interrelationship becomes possible through the use of a single personnel information classification system for an entire sector and is the basis for the further development and improvement of the management automation system without having to fundamentally rework it.

The sectoral standard OST 160.801.091-83, "Database of the Personnel Management System at Enterprises and in Organizations of the Ministry of the Electrical Engineering Industry" has been approved and implemented by a decree of the ministry.

Trial operation of the ASUP-Kadry based on the sectoral standard and its software was conducted during 1984 at base enterprises in a sector; this operation concluded with the system being turned over for industrial service. An analysis of the trial operational data on the ASUP-Kadry system demonstrated its positive impact on the organization of personnel work: parallelism and duplication of the efforts of numerous services were eliminated; it became possible to eliminate a whole series of cards as well as file and group documents in personnel departments, the management of which required considerable labor by department workers; the reliability and promptness of personnel data accounting were improved; the capabilities of analyzing the make-up of personnel staffs and substantiated decision making were expanded; conditions were created for purposeful work concerning the selection and placement of personnel and labor and financial expenditures for the transmission of information to the OASU-Kadry system were reduced.

Considering the positive results from the trial implementation of the sectoral standard and the operation of the ASUP-Kadry system at base enterprises, the ministry has issued an order for the implementation of the sectoral standard, its software and based on this, the ASUP-Kadry in all enterprises and organizations of the sector, starting in 1985.

8225
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THE SYSTEM FOR ORGANIZING STANDARDIZATION AND UNIFICATION EFFORT AT KRIOGENMASH RESEARCH AND PRODUCTION ASSOCIATION

Moscow STANDARTY I KACHESTVO in Russian No 5, May 86 pp 63-64

[Article by V.F. Polushkin, chief of the main standardization department, Kriogenmash Research and Production Association, under the rubric "From Work Experience": "The System for Organizing Standardization and Unification Effort at Kriogenmash Research and Production Assocation"]

[Text] Developing and improving the forms and methods of standardization and unification is the major way of reducing the number of types and sizes of components and assemblies, creating new products more rapidly and at a lower cost, improving the productivity, upgrading the product quality and raising the efficiency of production.

Kriogenmash NPO [Research and Production Association for Cryogenic Machinery] is operating in the conditions of constantly changing nomenclature of products, so that for meeting its production plan targets it must consider the aspects of standardization and unification quite seriously. The organization is involved in efforts to improve the structures of annual standardization plans, select the objects and basic principles of planning, etc.

Currently, the plans of standardization consist of two phases: long-term plans (for five years) and annual plans (month-by-month). The main principles of planning are to make it comprehensive and systemic.

The major objectives in standardization have been defined:

- raising the quality and scientific and technical level of NTD [scientific and technical documents] when these documents are created or revised;
- continuing to introduce YeSKD [unified system of design documentation], YeSTD [unified system of technological documentation], YeSTPP [unified system of technological preparation of production], YeSPD [unified system of programming documentation] and other interindustry systems of standards;
- expanding the efforts to create comprehensive systems for managing product quality, efficiency, scientific and technological progress and technological preparation of production, etc.

In order to raise the scientific and technological level of the NTD currently in use, the documents are checked and revised so as to identify and replace obsolete characteristics by those which are more up-to-date.

New NTD instead of those used by the organization are developed only when the introduction of new indicators, norms, requirements and design decisions would affect the basic specifications of the object of standardization and interfere with the interchangeability of objects. In other cases, standards are revised in accordance with the existing NTD, and their expiration dates are extended. We know from experience that with this strategy the amount of corrections in design, technological and production-planning documents is drastically reduced and the introduction of new concepts into industry is accelerated.

The goal-programming method of planning makes it possible to see clearly the goals and prospects of standardization and to accomplish planned tasks on time.

The organization is giving much attention to availability of normative-technical documents for all research, design and development projects and for the manufacture of basic and subsidiary products.

Studies have been conducted and have suggested the following conclusions:

- the largest numbers of NTD of all types refer to the general-technological standards specifying the requirements to all products developed and manufactured by Kriogenmash: limitations to the applicability of design decisions, series parameters and strength estimates and testing methods. The design and sizes of components and assembly units of general engineering applications alone are covered by 186 general technological standards;

- the largest number of NTD refer to air-separating units (VRU)--120, and pipeline fittings--22;

- in view of the large nomenclature and different types of products designed and manufactured by the enterprise and the large percentage of new products introduced every year, it can be assumed that most types of products are covered by normative-technical documents. Practically all parts and assembly units of general-engineering application have been standardized;

- NPO Kriogenmash has standardized fittings, tools and appliances (approximately 80 percent in mechanical production and 50 percent in assembly and welding); this includes virtually all of the fittings, tools and appliances of multiple use (710 NTD). The frequently recurring operations are covered by standard production processes (welding, painting, conservation, metal and nonmetal coatings, etc.)--117 NTD.

A closer analysis of the structure and types of standards and their quality, however, revealed the following shortcomings:

- the low utilization rate of many of the objects of standardization because of unjustified expansion of type and size series. For example, of 19 rated

pressure values specified by the limiting standard OST 26-04-981-74 only 8 are used frequently; of 29 values of rated gaps specified by OST 26-04-1250-75 only 7 are mostly used;

- the utilization rate of components and assembly units of the catalogues of standardized products is approximately 25-35 percent.

Based on a systematic revision of NTD and analysis of the development of new documents, the entire normative-technical documents in use at NPO Kriogenmash have been brought into conformity with the existing technical level; this means that the products designed and manufactured according to this NTD correspond to present-day standards.

The unification of products, components and classes of production processes and equipment depend mainly on the information support of these efforts at all stages of design and development. In support of these efforts, a generic system of document notation has been introduced in parallel with the unification of products, their components and design solutions.

The system was introduced stage-by-stage:

- at the first stage, before introducing the generic system, efforts were undertaken to unify the circuit concepts, plant and equipment units, which made it possible to proceed to developing a unified series of product components on the basis of existing designs and basic production procedures; on this basis eventually a series of VRU types was created arranged according to the air-processing capacity.

For the basic circuits and unit series, the series of standardized fittings, turboexpanders, shields and consoles and series of equipment units were developed, which made it possible in many cases to use the same piece of equipment or to standardize its components. As a result of the general work on unification of control and monitoring systems, the VRU units KAr-30 and KtK-35-3 are furnished with a set of three standardized signalization boards (instead of 25 signalization cabinets used previously), reducing the labor costs of manufacturing these units by a factor of 2.

The number of power input cabinets has been reduced (from 17 to 5), as well as the number of turboexpander cabinets (from 5 to 2), etc.

At the second stage of unification efforts, a generic system of notation of design documentation was introduced which made it possible to reduce the number of assembly units and components by 30 percent on the basis of standardized series and large-scale adoption of standard configurations.

At present, 136 catalogues of standard unified assembly units and components are available. The unified series of assembly units and components are in use in all air separation installations of types KAr-30, KAAr-15, AKt-30, KAr-32 and others.

The standardization level of equipment has been greatly improved and the volume of documentation has been cut approximately in half.

At the third stage, all design documents are being created with the use of generic notations, which raises the level of product unification among the different projects on the basis of typical design concepts, and in addition yields reduced labor and material intensiveness. Catalogues of standardized sections of cryogenic pipelines and pipeline elements (joints, supports, clamps, etc.) have been created, making it possible to build pipelines virtually with no working blueprints; subsequently, the design processes will be computerized.

The economic effect from reducing the volume of technical documentation at NPO Kriogenmash, even disregarding the standardized production processes, has been estimated provisionally at 843,000 rubles per year.

The growth of production volumes planned for the 12th Five-Year-Plan period (by 40 percent compared with 1985) will only be possible if the level of interproject unification is raised, which will make it possible to introduce a system of computer-aided design of products (SAPR technology), improve the computerized system of technological preparation of production (SAPR production processes) and introduce flexible production systems on the basis of numerically controlled machines and robotic engineering complexes [RTK].

To meet these goals, two programs must be implemented during the 12th Five-Year-Plan period: the improvement of products of cryogenic technology on the basis of technicoeconomic analysis, unification and standardization; and the development of products of cryogenic technology on the basis of CAD, which will lead to further unification and standardization of the manufactured products.

9922
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GROUP COMPUTERIZED NUMERICAL CONTROL SYSTEM

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 86 pp 40 - 42

[Article by Engineers I.P. Potekhin, A.O. Talashev, R.G. Ziganshina, S.L. Rumyantseva, O.S. Chechurina and N.B. Padalka]

[Text] As is well known, about 50 percent of the operational failures of numerical control devices (UChPU) occur in the photoelectric readers. For this reason, in order to improve the operational reliability of NC machine tools, the control programs are transmitted to the NC equipment via communications channels from a central (control) computer*, i.e., group computer-aided numerical control (GChPU) [group CNC] is used. The operational reliability of the machine tools as well as the flexibility when changing over to a new control program are improved in this case, because of the reduction in the implementation time as well as the realization of real-time control program editing and automated preparation systems in the control computer. The presence of computers makes it possible to set up the accounting for machine tool downtimes and analyze the reasons for this as well as take into account and analyze the operation of the tool as well as other functions that improve the operational efficiency of the machine tools.

The computer-aided group numerical control system creates the prerequisite for the comprehensive automation of machining work.

The organization of and experience with the design and implementation of group computer-aided NC systems are discussed in this article. Two variants of group CNC system structures based on the SM-1 computer were implemented (Figure 1). In the first, which was used for a small number of attended machine tools, the NC hardware was connected directly to the control

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*Kardanskiy L.L., Naydin Yu.V., Chudakov A.D., "Tsentralizovannoye upravleniye mashinostroitelnym oborudovaniyem ot EVM" ["Centralized Computer Control of Machine-Building Equipment"], Moscow, Mashinostroyeniye Publishers, 1977.

computer. The control programs could not be fully incorporated in the main memory because of its limited capacity for several machine tools (operated simultaneously), that did complex machining of parts. For this reason, in order to organize the output of the control program, a buffer region was assigned to each piece of NC equipment; the control program was fed out byte by byte through this buffer region to the NC unit.

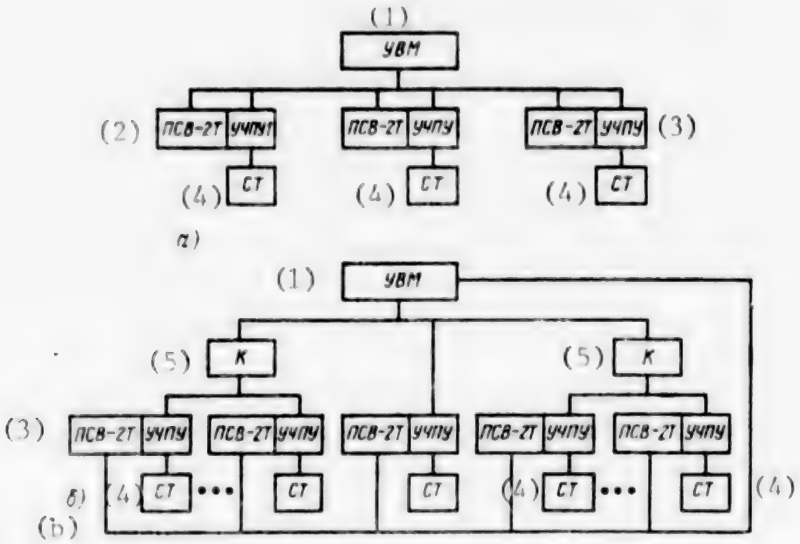

Figure 1. The structure of computer-aided group numerical control systems.

Key: a. With the connection of the NC equipment units directly to the control computer;
b. With the connection of the NC equipment units to the control computer through the concentrators;
1. Control computer, SM-1;
2. PSV-2T communications console;
3. NC equipment unit;
4. Machine tools;
5. Concentrators.

Two methods of filling the buffer regions are possible; in the first, the buffer region is split into two parts: during the process of feeding the control program out to the NC unit, the next block of the control program is read out of the external memory from one half to the other half. The size of the buffer region is calculated in this case by working from the external memory access time, the minimum frame processing time and the number of

connected machine tools, so as to assure their continuous operation even when all machine tools operate at the maximum control program frame query rate. Otherwise, any delays during the transition from one half of the buffer to the other can lead to NC unit downtime.

With the second approach, the size of the buffer region is determined by the size of the process transition - the portion of the control program between tool changes. The control program is fed out from the external memory into the main memory in this case by the process changes; slight delays between them do not entail downtime of the NC units, i.e., the system becomes more reliable. However, this method is applicable with a comparatively small size of the process transitions, since in the final analysis, it is specifically this parameter that determines the number of machine tools that can be connected. Thus, the method of loading the buffer regions is selected for each group CNC system as a function of the requirements placed on the system.

The second structure is more acceptable for the case when a large number of machine tools are connected; in this structure, the control program is fed out to the NC unit through concentrators based on the "Elektronika-60" microcomputer. A buffer region equal to the maximum size of the process transition is assigned in the main memory of the concentrator to each machine tool, while in the main memory of the SM-1 computer, a buffer region equal to the size of the magnetic disk storage sector is assigned to the CNC control units and to the concentrators.

One buffer region can be used for all of the concentrators with the monopoly transmission of the control programs to the concentrators. With this structure of the group CNC system, the capabilities of the real-time disk operating system are realized more fully, since a large memory region can be set aside in the main memory of the SM-1 computer for the execution of disk resident and background tasks. The capability of increasing the number of tasks that can be executed as well as expanding the functional capabilities of the group CNC system is created.

A group numerical control system with the second structure (Figure 2), implemented at one of the enterprises, is trated here by way of example. The PSV-2T console was installed for data exchange with the control computer for each machine tool. The NC units are connected to the computer through the nonstandard DC isolation units, the GR-1 and VGR-1; the consoles are connected through standard USO interface modules (MVvIS, MKUB and MVvDS); the concentrators are connected through the IRM-1 interface splitter by means of a duplex register for the SM-1 computer and a I1 connector on the concentrator side; the circuit has DC isolation.

The group CNC system provides for centralized storage and on-line editing of the control programs, the distribution of the control programs among the NC units as well as accounting for the running time of tools and machine tool downtimes.

The control programs for NC machine tools are stored in a magnetic disk library and the entries are made from punched tapes prepared by the process

engineers. When a control program is fed in from a punched tape and written onto a magnetic disk, it is broken down into the process changes (TP) with the generation of the reference information for the entire program as well as just with respect to the process changes. The information contains the part operation code, the number of process changes, frames and bytes and is used for the output of the control program to the concentrators and the NC units. When a control program is written into the library, a catalog is produced that can be used to determine the composition and location of the control program on the magnetic disk. A provision is also made for the capability of punched tape output of the control program as well as output to a display module (DM) and printout, while the catalog and the reference information can be printed out or shown on the display module. The library is checked daily to maintain the control programs in operating condition.

The editing of the control programs is accomplished in an interactive mode from a DM-200 display module. Changes are made directly in the text from the display module keyboard; a provision is made for the capability of merging control programs, syntax checking, renumbering the frames, replacing an initial word with a correcting word in accordance with a specified search window, replacing selected values of words, rearranging a group of frames, changing the signs of coordinates defined by a list and readdressing the coordinates (substituting y for x, etc.). There is the capability of showing the instructions on the display in order to curtail the time needed to learn to work with the system.

The output of a control program to a numerical control unit is accomplished on the basis of the daily shift assignment at the start of the shift from the display module by the operator of the control computer complex or at the request of the conditional control program number from a PSV-2T console by the machine tool operator.

The address of the requisite control program on the magnetic disk storage is determined from the library catalog. The control program is read out in sectors of 128 words each into buffers set aside in the common memory region of the main memory of the SM-1 computer. The control program is fed out byte by byte to the Fanuk-3000S numerical control unit from the secured buffer upon a request from the peripherals. The control programs for the type NC [Latin letters] UChPU [numerical control units] are transmitted from the magnetic disk storage to the concentrator in a whole number of process changes; the size of these changes does not exceed the buffer of the concentrator asigned to the machine tool being operated. The capability of placing a process change in a buffer is determined from the change handbook. The control program is fed out from the concentrator buffer to the numerical control unit byte by byte in frames. After the information from the buffer has been exhausted, an input query is generated for the next portion of the control program, based on which either the next control program block is transmitted depending on the stage of the processing of the control program and the status of the task execution, or the next part is authorized for machining with the loading of the entire control program in the buffer, or the first block, again requested by the control program, is transmitted. In

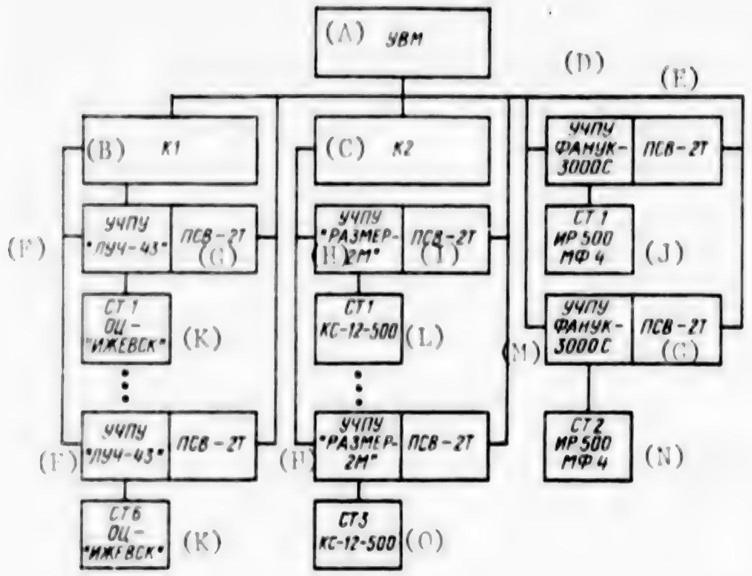

Figure 2. Block diagram of the group computer-aided numerical control system.

Key:
- A. Control computer;
- B. Concentrator 1;
- C. Concentrator 2;
- D. Fanuk-3000S CNC units;
- E. PSV-2T communications console;
- F. "LUCH-43" CNC unit;
- G. PSV-2T;
- H. "RAZMER-2M" CNC unit;
- I. PSV-2T;
- J. ST 1 [machine tool 1], IR 500, MF 4;
- K. ST 1 [machine tool 1], "IZHEVSK" OTs;
- L. ST 1, KS-12-500;
- M. FANUK-3000S numerical control unit;
- N. ST 2 [machine tool 2], IR 500, MF 4;
- O. ST 3, KS-12-500.

the case of an alarm for an emergency situation at the machine tool, the output of the control program to the numerical control unit is terminated. In order to continue operation, it is necessary to request the requisite control program from the PSV-2T console. The output of the control program to the numerical control unit is accompanied by a readout; when the requisite control program is present in the library, the "Control Program Present" message is displayed on the console; and when it is absent, the "No Control Program" message is displayed. Following the transmission of the control program to the concentrator buffer or the FANUK-3000S numerical control unit, the control program is ready, which is signals the capability of starting the machine tool.

The lack of work pieces, tools, attachments, a control program, a task or any defect causes the machine tools to shut down, accounting for which is carried out on the basis of the information fed in from the PSV-2T console. The reason for downtime is communicated to the master console (display module)

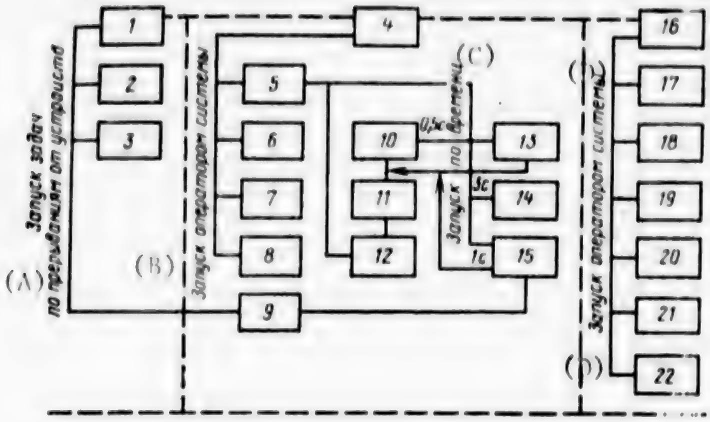

Figure 3. Task execution scheme for the group CNC system in the SM-1 computer.

Key:
1. Main memory resident tasks;
2. Reception and processing of interrupts from the RIM;
3. Task call in the absence of SWAP [Latin letters] swapping;
4. Disk resident tasks;
5. Initial start, PUSK [Latin letters];
6. Task correction for the resident module from the KORZA [Latin letters] display module;
7. Ouput of summaries on the resident module status, SOSRM [Latin letters];
8. Output of summaries on equipment downtimes and calls;
9. Task starting at the initiative from the DM [Latin letters];
10. Start of the KUS [Latin letters] group numerical control subsystem;
11. Generation of the current durability file, SMENA [Latin letters];
12. Declaration of the display module by the initiative INIT [Latin letters];
13. Control of the control program output to the CHPU [Latin letters] UChPU [NC unit];
14. Analysis of the information from the ELEKT [Latin letters] concentrator;
15. Analysis of information from the PSV-2T consoles, POIS [Latin letters];
16. Background tasks;
17. Generation of the files for tool durability, FAIN [Latin letters];
18. Writing the tool norms into the magnetic disk storage;
19. Printout of the document on the durability of the tools, WEST [Latin letters];
20. Generation of the files on the equipment downtimes, FAIL [Latin letters];
21. The segmented task REDAKTOR UP [CONTROL PROGRAM EDITOR];
22. The segmented task BIBLIOTEKA UP [CONTROL PROGRAM LIBRARY];

A. Task start in accordance with the interrupts from the peripherals;
B. Start by the system operator;
C. Time-based start;
D. Start by the system operator.

in order to take steps to correct it. Information on the amount of equipment downtime is accumulated from the beginning of the month and from the start of a shift; summaries of this data are fed when necessary to the master or operator's console as requested.

Upon the completion of the machining of each part, the remaining tool durability is monitored. If the standard wear point has been reached, an indication of the necessity of changing of the tool is displayed on the PSV-2T console, with an indication of the number of the bin in the tool dispenser; further control program feedout is blocked until information is received from the PSV-2T concerning the status of the tools. When a tool is changed, its normative durability is updated; when the blocking is removed without changing the tool, the data needed to update the accuracy of the wear norms is accumulated. The document logging the residual tool durability in the tool dispenser for the machine tool is printed out when the part machining operations on the machine tools are changed or at the request of the operator at any point in time.

The software for the group CNC system (PO GChPU) is implemented on the SM-1 minicomputer in a real-time disk operating system (DOS RV) and on the "Elektronika-60" microcomputer. The real-time disk operating system provides for multitask operation of the system and makes it possible along with the controlling of the machine tools to edit the control programs, write them into the library, read them out, etc.

The software for the SM-1 is implemented by the following:

--The main memory resident task, which receives and processes the queries for data input from the concentrators, the PSV-2T control consoles, the FANUK-3000S numerical control units;

--The disk resident tasks that execute the initial start of the system, the reception of tasks for the machine tools from the on-line control subsystem, the processing of the data received from the PSV-2T consoles, the control of the control program output, the accounting for the operation of the equipment, as well as the analysis of the information received from the concentrators;

--Background disk resident tasks, that account for the equipment downtimes, generate the files for the accumulation of the information on equipment downtimes, generate and manage the library of control routines as well as their editing. The tasks are executed under the control of the task supervisor of the real-time disk operating system; they are broken down into those performed when signals are incoming from the concentrators, the FANUK-300S numerical control devices, the PSV-2T consoles, at the request of the operator as well as with a call from another task and in accordance with the time intervals (Figure 3).

Tasks are incorporated in a particular group depending on the functional purpose, organization of the execution and the informational interralationship to other tasks. Each task includes a definite set of modules and subroutines in accordance with the functional purpose.

The [illegible] [Latin letters] task sets all of the devices incorporated in the system to the initial state, generates the store locations of the common memory region, actuates the KUS [Latin letters] task for one-time execution, the [illegible] [Latin letters] task for periodic execution with a period of three seconds and the POIS [Latin letters] task for execution with a period of one second.

The KUS task sets up the initial state of the control program output spreadsheet in the NC units, receives the task from the operator's control console or from the concentrators for the machine tools, actuates the SMENA [Latin letters, CHANGE] task for periodic execution with a period of 0.5 seconds and the SMENA task for one-time execution. The following are included in the KUS task: the module for the start of the group CNC subsystem; the module for the interface channel between the SM-1 computer and the "Elektronika-60"; the subroutine for the reception of the task for the work stations; the subroutine for finding the number of the requisite control program in the library catalog; the subroutine for the generation of an element of the machine tool control program output spreadsheet; the subroutine for the reading of the control program handbook from a peripheral memory.

The [illegible] [Latin letters] task, in accordance with the daily shift assignment, reads the control programs out of the library and feeds them out to the FANUK-3000S numerical control devices and the concentrators. When changing a part machining operation at the work station, the CHPU task triggers the SMENA [Latin letters] task. The following subroutines are included in the task in addition to the modules and subroutines that provide for the reading and outputting of the control programs to the numerical control units: data output to the PSV-2T console and the system operator's console (the display module), as well as the accounting for the tool running time.

The [illegible] [Latin letters] task provides for the reception and processing of the queries for data input from the concentrators, the PVS-2T consoles and the FANUK-3000S numerical control devices. The task is an initiative task and is actuated for execution in accordance with an interrupt from the RIM unit. The task includes a module for the analysis of the RIM word state and FANUK-3000S drivers for the interprocessor interfacing and exchange with the consoles. The ELEKT task initiates the communications channel between the SM-1 and the "Elektronika-60" and processes the data received from the concentrators.

The [illegible] task processes the data incoming from the PSV-2T consoles; when a tool replacement signal is received, the SMENA task is switched to the standby and when information about faults and calls is received, the [illegible] task is activated by it.

The POIS task includes a module for the analysis of the information fed in from the consoles, subroutines for generating an element of the control program output spreadshee for a specified machine tool, finding [illegible] a control program in the library catalog, reading the control program handbook from a peripheral memory, analyzing the queue for tool changing, updating the information on the durability of the changed tool as well as accounting for equipment downtimes.

The SWODK task implements the output of the summary of equipment downtimes based on the accumulated information per shift and from the beginning of the month, as well as the summary of calls from the work stations.

The SMENA task creates the current file of data on the durability of the tools for the new control program and feeds out the document reporting the remaining tool durability based on the previous control program.

The WEST task is provided for the printout of the document reporting the remaining tool durability for all of the machine tools or for particular machine tools; this task is executed at the request of the operator. The status of the forwarding of the control programs to the NC units for all the machine tools or for a specified one is fed out by means of the [illegible] [Latin letters] task at the request of the operator.

The capability of starting the on-line tasks for editing the control programs, generating and managing the control program library as well as the output of the summaries to the shift foreman's display module is also provided. This is accomplished by the DM [Latin letters] task when particular [illegible] keys are pressed on the display module. The inclusion of the display module in the list of initiative devices is accomplished by the INIT task. The segmented tasks of editing the control programs, as well as generating and editing the control program library consist of the main ARDI and [illegible] [Latin letters] programs and nine and eight segments, respectively. [illegible] programs receive the requisite function and call up the appropriate segment for execution.

A main memory resident region of about 1.5 Kwords, a disk resident [illegible] capacity of about 5.5 Kwords and a background disk-resident capacity of 14 Kwords are needed for the operation of the software of the group numerical control system. The software implemented with the "Elektronika-[illegible]" microcomputer executes the output of the control programs to the [illegible] [Latin letters] numerical control devices, the interfacing with the SM-1 computer, and actuates the dispatcher program, the SM-1 interface driver and the driver for interfacing to the numerical control units. Both drivers operate in accordance with the interrupts from the SM-1 and the numerical control units, respectively; one byte of data is fed out per interrupt.

The software employs a modular design principle, which makes it possible to easily update and expand the complement of functions that can be performed.

The group CNC system has been placed in production.

8225
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EXPERIMENTAL ZONE OF AKADEMSET PUT INTO OPERATION

Moscow TRUD in Russian 21 Jun 86 p 2

[Article by E. Yakubaytis, vice-president of the Latvian SSR Academy of Sciences, chief designer of Akademset', Riga: "Computer Dialogue"]

[Text] The call letters of Novosibirsk appear on the display screen at the Institute of Electronics and Computer Technology of the Latvian SSR Academy of Sciences. The computer operator in Riga through communication channels enters into a dialogue with the computer at the Computer Center of the Siberian Department of the USSR Academy of Sciences. Information flows fill the screen wave after wave. Computers in Riga and Novosibirsk, entering into a network interaction session, jointly perform information processing and transmission functions.

An important event took place in the country's scientific life: An experimental zone of Akademset' [Academy network] was put into operation. Such a large-scale complicated information complex was established in the country for the first time.

Every two or three years the volume of scientific and technical information doubles. It is clear to everyone that it is no longer possible to process it without electronc hardware. However, this is the trouble: Computers are now available at many enterprises and organizations, but are utilized poorly. As a rule, they are running at capacity only 3 or 4 hours a day. Often even the most expensive computers operate no longer than half a day and not in a multiprogram, but in a single-program, mode, as a result of which the computer "brain" is occupied approximately 20 percent.

How to bring its usage level, for example, up to 95 percent so that, as the saying goes, steam comes out from the computer?

It is necessary to organize the matter in a new way and to put an end to the narrow departmental approach. The establishment of associations of computers called information networks has become an urgent demand of the times. If scientists and production organizers receive displays and join such networks

in order to actively utilize collective information banks, this will be equivalent to a double or triple increase in the pool of expensive computers and expenditures on computerization will be reduced manyfold. The saving of funds will amount to hundreds of millions of rubles.

Now on the basis of local information networks automatic shops are being built, "paperless" information processing is being organized in institutions, and "electronic" classes are operating in schools. Computers located hundreds and thousands of kilometers away from each other enter territorial information networks.

Such networks will make it possible to establish a statewide industry for the dynamic processing of vast information files. Large specialized data banks will be introduced and any collective will receive an access to them.

Akademset', which is being established by the institutes of the USSR State Committee for Science and Technology and of academics of sciences of the country and the Union republics, is an important stage on this strategic path. The experimental zone of Akademset', which includes 55 interacting computers, has just been put into operation.

The first stage of Akademset' has such universal characteristics that it can serve as a prototype of networks of various ministries and departments. Moreover, regional networks can also be formed on its principles.

The advantages of the experimental zone have also become obvious for academic collectives. After all, more than 100 microcomputers control information transmission, eliminate the errors occurring in the process, and ensure the collective use of communication channels. I would like to note the following: More than 40 computers can now operate through the same channel simultaneously. As a result, the cost of information transmission drops sharply. There is another important indicator--the speed of access to information.

The concept of Akademset' is based on the basic standard model of the International Organization of Standards and Soviet specialists now can not only use the large data banks created in our country, but also promptly interact with information centers in Europe and in other continents. It is also important that Akademset' is open for supercomputers, medium-size computers, mini- and microcomputers, and personal computers--all of them "understand" each other well.

First-stage operations have been completed. Placing Akademset' in the optimal operating mode in order to utilize its resources for 24 hours is next. Subsequently, the operating zone of Akademset' will expand dozens of times and will encompass new scientific centers.

It should, however, be noted that, when information networks are established and put into operation, considerable difficulties are encountered. State networks for switching electronic packets, that is, unification of data into blocks, operate in almost all developed countries nowadays. However, the USSR Ministry of Communication has not yet established such a network. Therefore,

various departments and ministries are forced to form their own packet switching networks operating in parallel in the country. The result is alarming: Expensive thousand-kilometer communication channels are loaded poorly and the expenditure of funds is very big.

The lack of personnel for the operation of networks in organizations, whose computers enter Akademset', is another difficulty. It is necessary to promptly establish a special service, to place its subdivisions in all major scientific centers, and to organize their interaction.

The lack of preparedness of scientific research institutes of information for the new network method of provision with their data is the third difficulty. In order that these scientific research institutes may operate normally in Akademset', special subdivisions should be established in them and computers should be additionally outfitted with a big memory on magnetic disks.

Unfortunately, attention must be drawn to the fact that only one plant of the Ministry of Instrument Making, Automation Equipment, and Control Systems manufactures the equipment necessary for the creation of information networks. It is insufficient both in terms of quantity and assortment. The USSR Ministry of the Communication Equipment Industry completely withdrew from this matter.

It is necessary to overcome all the difficulties and shortcomings as quickly as possible. After all, nowadays the information resource is the same state wealth as fuel and power resources. Under conditions when the national economy sharply turns to the path of intensive development nothing can replace this resource.

11439
CSO: [illegible]

EDUCATION

ON COMPUTER LITERACY

Moscow VESTNIK STATISTIKI in Russian No 4, Apr 86 pp 46-49

[Article by G. Yakovlev, deputy chief of the Main Skills Improvement Administration (GUPK) of the Central Statistical Administration USSR, under the rubric: "Mechanization of Statistical-Accounting Operations"]

> [Text] "To more actively assimilate informatics and computer science into the academic process:"
>
> The fundamental directions of the economic and social dedevelopment of the USSR for 1986-1990 and through the year 2000.

In light of the requirements of the general-education and vocational school reform, the "Basics of Informatics and Computer Science" course was introduced in 1985 in the general-education and vocational and technical schools of the nation. It is intended that two years be given to the study of this subject in the schools. Thirty-four hours are allotted in the 9-th grade, while in the 10-th grade (in dependence upon the opportunity for organizing the computer work) the volume and subject matter of the course assume two variants: Full and short courses. The first is intended for schools that already have computers available or have the capability to organize systematic lessons at the computer centers of other organizations. Those schools that do not yet have this capability will teach the short course.

The principal goal of the course is to develop in the students the concepts of the fundamental principles and methods for solving problems with the computer, their familiarization with the role of computer science in modern public production and the prospects for its development. Informatics and computers will become the basis for the study of a number of natural-science subjects on a qualitatively different level. They significantly expand the horizons of pupils and help them to acquire the most important skills in establishing solution variants of academic problems and to select the optimal ones from among them. Tens of thousands of school, tekhnikum and Professional and Technical School (PTU) teachers received course training in 1985 at higher educational institutions of the corresponding specialization in order to successfully solve the task of instructing pupils the bases of informatics and computer science.

The "Technical Instruction Facilities and Computer Science" course was intro-

duced at all pegagogic VUZ's; the training of mathematics and physics teachers in the "Informatics and Computer Science" specialty is also beginning. Specialists from enterprises and scientific research institutes and the scientific and pedagogic workers of VUZ's can be enlisted to teach as permanent staff members who will continue to hold their regular job.

Vocational orientation and training of the senior students of general-education schools are being conducted in the academic network of the Central Statistical Administration [TsSU] USSR in connection with the school reform. In a number of educational combines and accounting schools the students can receive the skills of computer operator (general specialty) and electromechanical technician for the maintenance and repair of microcalculators.

For example, students of the Gor'kovskiy Oblast' Educational Combine have received since 1979 the vocation of electronic keyboard computer operator through the interscholastic academic and production combine of the Soviet Rayon Department of Public Education (RONO). The work is conducted according to agreements made between the academic combine and the RONO and between the educational combine and the host enterprise, in this case the Computer Center of the Statistical Administration of the Gor'kovskiy oblast. The interscholastic Skills Improvement Administration (UPK) recruits the academic groups.

The computer center of the statistical administration prepares the instructional facilities (the classrooms), provides the appropriate conditions for the instruction and productive work of the students, repairs equipment and computers, assigns experts to teach students, maintains accounts for the work accomplished, and covers the classroom operation costs.

The educational combine works according to standard academic plans that are approved by the GUPK of the TsSU USSR, equips the classrooms with computers and visual aids and stands, assigns teachers to instruct students, and supervises the quality of the academic work. Each group's lessons are conducted one day per week for 6 hours (4 hours is allotted to lecture and 2 hours for practical lessons).

The students of the operator training groups accomplish the account processing of the statistical administration computer center documents. Their labor is recompensed by the computer center on the basis of effective rates and output. The students of the electromechanical technician groups repair the computer center's computers. The quality of the work is supervised by a teacher from the educational combine. Every year in June the students study production practice at the computer center and then take examinations. The examination commission includes teachers from the educational combine and representatives of the RONO, the interscholastic UPK and the host enterprise.

Beginning in January 1985, the Gor'kovskiy Educational Combine began training electronic keyboard computer operators and electromechanical technicians through the interscholastic UPK of the public education department of the city of Dzerzhinsk.

The vocational training of 9-th grace students of school No 610 of the

Sokol'nicheskiy rayon of the city of Moscow in the "General Specialty Electronic Keyboard Computer and Microcomputer operator" specialty was begun on 1 Sep 1985. The host enterprise for this school is the TsSU USSR. Two classrooms have been equipped at the school: One contains two "Iskra-226" personal computers, one "Iskra-555" electronic accounting machine and five YeS-9004 magnetic tape data preparation devices; the other contains microcalculators. Each student has a personal MK-59. Problems in the operation and repair of these computer facilities are solved. The lessons are conducted by teachers from the Moscow Educational Combine for Mechanized Accounting Personnel Training according to a program approved by the GUPK especially for this school. The program is designed for two academic years, with a total training period of 420 hours. The study of occupational safety issues, the fundamental trends of computer development, programming basics, computer operation and the computer processing of information is provided for. The sections of the program on programming basics, operation and computer information processing stipulate both theoretical and practical training. Specific requirements are made to assure that the material of each subject is mastered. A typical list of literature for the students and teachers is given by the program.

During instruction, the peculiarities of constructing mathematical models are demonstrated and the capabilities of electronic computers and their increasing significance in production are revealed. The skills of constructing algorithms and programming mastery that are developed in the students during instruction create a basis for broad mathematical generalizations and aid in the development of mathematical thought. Instruction in working with the computer prepares the future production worker for the practical implementation of his acquired skills in modern public production, which is extensively equipped with microprocessor and computer facilities.

The first pass-examinations conducted at the No 610 school of Moscow and questionnaires there demonstrated that the students had assimilated computer science basics successfully and with great interest.

Following instruction in vocational training groups, those students who will reinforce the ranks of computer center workers will be able to work with modern computers. The scholastic knowledge that they have acquired in this field will help them to quickly master the new specialty and work at the level of current scientific and technical knowledge.

It is good to acquire a future vocation while still in high school. But the question arises whether computer literacy training in the schools will yield the proper return when the electronics "park" is undergoing constant renovation. Here one should keep in mind that the pupils are trained on computers that will be functioning in the economy for a long time to come. But the principle thing, perhaps, is that the knowledge acquired by the pupil can be utilized to work with any computer, since he learns the bases of informatics and machine language, and finally, the skills of working with the computer are cultivated in him.

A general instruction course for the students of general-education schools on computer science basics and programming is predetermined by the current level of

production and by the demands which the economic system makes of the educational system. The continued development of science, engineering and economics would be impossible without the computer. The human being is liberated by the computer from routine, mechanical work. This is the reason that today's school graduate must possess elementary knowledge about informatics, i.e., about the rules of retrieving, storing, dispersing and using information and about the optimal organization of information activity. In addition, computer science in the school attracts specialists to enter its walls, brings pupils together with programmers and technicians and widens their range of ideas about vocations. Already the first results of instructing the students of general-education schools in computer literacy has shown that the assimilation of the computer's capabilities favorably affects the academic process as well.

Individual academic institutions of the TsSU, the RSFSR, the TsSU of the Ukrainian SSR, the TsSU of the Kazakh SSR and of several other Union republics are providing additional training to school and PTU instructors in the problems of informatics and computer science, simultaneously with vocational training of general-education high school students. However, experience has shown that the organs of the Ministry of Education of the USSR and the State Committee of Vocational Education of the USSR do not at all fully utilize the academic network of the TsSU USSR in implementing training and pupil vocational orientation tasks and in providing additional training to teachers on the bases of informatics and computer science.

Now different models of computer facilities are entering the high schools of the nation. The training of electromechanical technician-specialists is accomplished by the educational institutions of the Main Administration for Accountant Training and Skills Improvement system of the TsSU USSR.

The GUPK of the TsSU USSR has designated educational combines to train specialists in the maintenance of such scholastic computer facilities as the "Elektronika DZ-28", the "Elektronika-60M", the "Agat" personal computer, the BK-0010 home computer, and interactive computer sets. Educational institution teachers have been trained by the factory-producers of this equipment. The GUPK of the TsSU USSR has developed the corresponding educational-standards documentation for training these specialists. Already the first electromechanical technician training courses have been taught at the Minsk, Donets, Voronezhsk, Novosibirsk, Alma-Ata, Kiev and Kursk educational combines. A proposal has been made to expand electromechanical technician training work in 1986.

The training of general-education school students in computer literacy is a new direction in the work of the educational institutions of the TsSU USSR. They have already accomplished extensive work over many years in instructing computer literacy to specialists for the TsSU USSR system and sectors of the economy. More than 80 ministries and departments train about 30 thousand programming and computer operation and maintenance specialists every year for computer equipment of all levels and automated control systems. Computer literacy is being taught to the accounting personnel of enterprises and organizations in conformity with stipulations for a cardinal improvement in computer utilization effectiveness when processing economic information.

The GUPK is reexamining old educational plans and programs or creating new ones in terms of specialties and forms of instruction which assure a high level of student training. Manuals on leading instructional methods are being published for teachers.

At the present, the academic network of the TsSU has available 240 educational institutions in all Union republic capitols, kray, autonomous and oblast centers. The presence in them of qualified teachers, the requisite technical materiel, and rich, practical experience enables specialists in programming, teleprocessing, and the operation and maintenance of computers, from microcalculators to YeS computer facilities, to be trained on a wider scale.

A significant role in computer literacy instruction belongs to the Intersectorial Institute for Skills Improvement of Supervisory Workers and Specialists in the field of statistics, computer information processing, accounting and control created in the TsSU USSR system.

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FIFTH CONFERENCE ON ELEMENTARY SCHOOL INFORMATICS HELD IN LENINGRAD

Leningrad LENINGRADSKAYA PRAVDA in Russian 19 May 86 p 3

[Article by I. Sidorov: "Adults, Give Us a Problem!"]

[Text] The speakers shifted from one foot to the other over the Whatman sheet filled with symbols.

"Comrades, on the poster you can see...," one of them began briskly and the audience started to laugh joyfully. The speakers blushed. They were 10 years old. The twin brothers Kostya and Andrey Ivanov had come to the conference on school informatics in order to make a report on a program they had developed.

At this the smiles ended. The audience listened to them quite seriously and asked them questions. The grandmother of the Ivanov twins perched herself in a corner and nodded her head, listening to technical terms. Standing still, Olga Sergeyevna Tkacheva from the 30th school in Vasileostrovskiy Rayon devoured every word--she conducts an "informatics" circle for the children. When the twins with dignity thanked the audience for its attention, she beamed and lifted her thumb up: Everything is perfect!

Such were these two days: Seniors listened to young children and a schoolchild argued with a professor. This atmosphere was amazing, full of comradeship and good will, where there were no masters and novices, but where, together, arguing and demonstrating, people sought, above all, the truth. And not only at conferences. The branch of knowledge new for schools powerfully drew into its orbit all inquisitive, searching, and creative people, regardless of their age. Perhaps the distinct formation of a wide circle of people, pedagogues, and children fascinated by this science was one of the most impressive achievements of Leningrad elementary school informatics last year. Why did this happen?

First of all, however, a few details about the brothers Ivanov. They have taken part in the informatics circle for 2 years and have mastered the programming languages Algol and Basic. "Here is an assignment for you," Tkacheva said one day, "ask your parents what difficult problems they have at work and try to entrust them to the computer." Three dozen small business-like people, full of determination, went home.

The Ivanovs first besieged their mother--she returned home earlier. The mother, seeing to the preparation of supper, answered absent-mindedly that she did not have simple problems at her job. The father was more obliging. Racking his brains, he recalled that at the design office a great deal of time was spent on the recording of materials necessary for the manufacture of parts. Perhaps this operation could be automated?

Kostya and Andrey wrote such a program and debugged it at the school computer center--now introduce it into production...

Again wunderkinds, the skeptic will sigh. An exceptional case... But I will say to this skeptic: Undoubtedly, the Ivanov twins are capable children, but there is nothing amazing in them. We should not be astounded by such cases, but by what forms the basis for the achievements of the small programmers: the tremendous interest of the young generation in the most improved technology of the century. This interest is of a unique popular nature.

Last fall the LENINSKIYE ISKRY newspaper began the game "your move, computer!" designed to introduce schoolchildren to the principles of computer literacy. The children's answers to the game's assignments--there are hundreds of letters!--can be read like a novel.

Vasya Khachaturov, a fourth grader from the 238th school, reported that he liked... to program in the Basic language, and his friend, in other computer languages as well. A second grader wrote that at her home there was a minicomputer built by her father, a candidate of sciences, and that she wrote game programs for the computer. Vova Khamenkov from the 528th school announced that "he had been interested in robots for a long time, since kindergarten." Yaroslav Gorshkov from the Novoselye settlement expressed the wish that "computers be taught from the first grade."

Letters also arrive from teachers. "Dear journalists!" one mother wrote. "Thank you. My boy was in bed with pneumonia. For 10 days his temperature did not drop and I was ready to drop. But the next issue of your game arrived and my son was so happy that he recovered..." Perhaps the mother exaggerated slightly. But this letter is the most interesting human document attesting to the depth and "quality" of interest of today's children in computer science.

In fact, there is nothing to be surprised at. During all the critical moments of the scientific and technical revolution this interest became more intense. Let us recall the biplanes, circles of aircraft model constructors, and the slogan "Komsomol for Aircraft!", which startled the imagination of young boys in the 1920's. Let us recall the first tractor, after which barefoot children ran in dust clouds, dreaming about sitting behind the levers. Today computer science has firmly taken the place of these miracles of the scientific and technical revolution in schoolchildren's consciousness.

However, there are also differences here. During the remote 1920's the contemporaries of today's brothers Ivanov could in no way sit behind the aircraft control wheel. Today's 10-year-old boys confidently engage in a dialogue with computers. In fact, the scientific and technical revolution places in their hands the most powerful technology of the century and this

process will expand and intensify. There is serious research demonstrating that such a "rejuvenation" of informatics is natural and useful. In childhood skills are acquired more easily and the logic of interaction with a computer is mastered more rapidly. It is best to master computer grammar, like any other grammar, in one's youth! Thus, children's avid interest in computers is not merely an interesting circumstance of the era of the scientific and technical revolution. This is of tremendous social value, this is our wealth.

To augment and fully utilize this wealth is our, the adults', concern.

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